GE
Measurement & Control

Moisture

Aurora H2O

User's Manual

imagination at work

910-284 Rev. E
April 2012

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Measurement & Control

Aurora H2O

Moisture Analyzer for Natural Gas

User's Manual

910-284 Rev. E
April 2012

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[no content intended for this page]

Information Paragraphs

- **Note** paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.
- **Important** paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.
- **Caution!** paragraphs provide information that alerts the operator to a hazardous situation that can cause damage to property or equipment.
- **Warning!** paragraphs provide information that alerts the operator to a hazardous situation that can cause injury to personnel. Cautionary information is also included, when applicable.

Safety Issues

WARNING! It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.

WARNING! Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures on the equipment.

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

GE Measurement & Control is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2002/96/EC.

The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Visit **http://www.ge-mcs.com/en/about-us/environmental-health-and-safety/1741-weee-req.html** for take-back instructions and more information about this initiative.

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Chapter 1. Features and Capabilities

1.1 Overview

GE's **Aurora H2O** *Moisture Analyzer for Natural Gas* makes it possible for natural gas processing and transportation facilities to monitor moisture content in real-time with high precision and reliability.

The **Aurora H2O** analyzer uses tunable diode laser absorption spectroscopy (TDLAS) to measure moisture in natural gas at the speed of light. The analyzer is suitable for installation in hazardous areas and operates over a wide range of environmental conditions. **Aurora's** fast response quickly alerts and documents when moisture concentrations are out of compliance. Once process upsets are corrected and the gas dries out, the fast response quickly enables natural gas to be cleared for entry into the "energy grid".

CLASS 1 LASER PRODUCT

WARNING!
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser exposure.

1.2 Features

- Optical response: <2 seconds once flow cell is purged.
- No cross sensitivity to glycols or amines.
- Direct readout in lbs/mmscf, mg/m^3 or ppm.
- Reads process pressure dew point (with user programmable constant or live auxiliary input for process pressure).
- Turnkey sampling system specifically designed for natural gas applications ensures measurement integrity.
- Magnetic Stylus enables through-glass programming – hot permit not required to field program.
- Explosionproof/Flameproof design
- 4-20 mA signals and RS-232/485 MODBUS RTU for connection to SCADA or plant monitoring system.
- Supplied with **AuroraView** software for remote configuration, data logging and data retrieval capacity.
- NIST traceable calibration.
- In conformance with IEC 60825-1 Edition 2.0, Safety of Laser Products.

1.3 Theory of Operation

The GE **Aurora H2O** (Tunable Diode Laser Absorption Spectroscopy) hygrometer for natural gas is a system designed to continuously monitor the moisture content in natural gas. It fundamentally measures the partial pressure of water vapor (water in the gas state), and with the simultaneous measurement of pressure and temperature, provides readings and both analog and digital signal transmission of user-selectable moisture parameters including dew point temperature, volume ratio and absolute humidity (lbs/MMSCF or mg/m^3) in addition to temperature and pressure.

The **Aurora H2O** is supplied with an integrated sampling system which includes an optional pipe-mounted liquid separator and pressure reducing valve/regulator, and the following components mounted within a stainless steel enclosure: isolation valve, coalescing filter, coalescer flow control valve, sample cell control valve, second pressure reducing valve/regulator, and flow indicator (rotameter), as well as an optional electrical heater and thermostat.

The fundamental water vapor pressure measurement is based on the *Beer-Lambert Law*:

$$A = \ln\left(\frac{I_o}{I}\right) = SLN$$

where: A = Absorbance
I = Light intensity transmitted through a sample gas
I_o = Incident light intensity
S = Absorption coefficient*
L = Absorption path length (a constant)
N = Concentration of the water vapor in the absorption cell

* The absorption coefficient is a constant for a specific gas composition at a given pressure and temperature.

The concentration of the water is directly related to the partial pressure. At certain specific frequencies, light energy will be absorbed by water molecules. As the concentration of water increases, the absorption also increases. The **Aurora H2O** sweeps the diode laser output across a narrow band in the near infrared spectrum and, by measuring the light intensity with a photo detector, is able to provide a direct indication of the partial pressure of water. The partial pressure, multiplied by 10^6 and divided by the total pressure, yields the volume ratio in ppm_v (parts per million by volume).

The laser diode is housed in a hermetically sealed and dry housing. The light is transmitted through a window made of proprietary transparent material. The light travels through a stainless steel cell and is reflected off a gold-plated mirror and returned to a photo detector, where the light intensity is measured.

1.3 Theory of Operation (cont.)

Since only light comes in contact with the sample of natural gas, and all of the wetted materials are made of non-corrosive and inert materials, this technology does not exhibit the drift associated with gas contacting sensor-based hygrometers. The diode laser emits low energy light, and therefore the system will not ignite the gas. The complete system is rated explosion-proof, and the **Aurora H2O** provides very fast response time. Once the absorption cell (see *Figure 1* below) is purged, the response time is a matter of a few seconds.

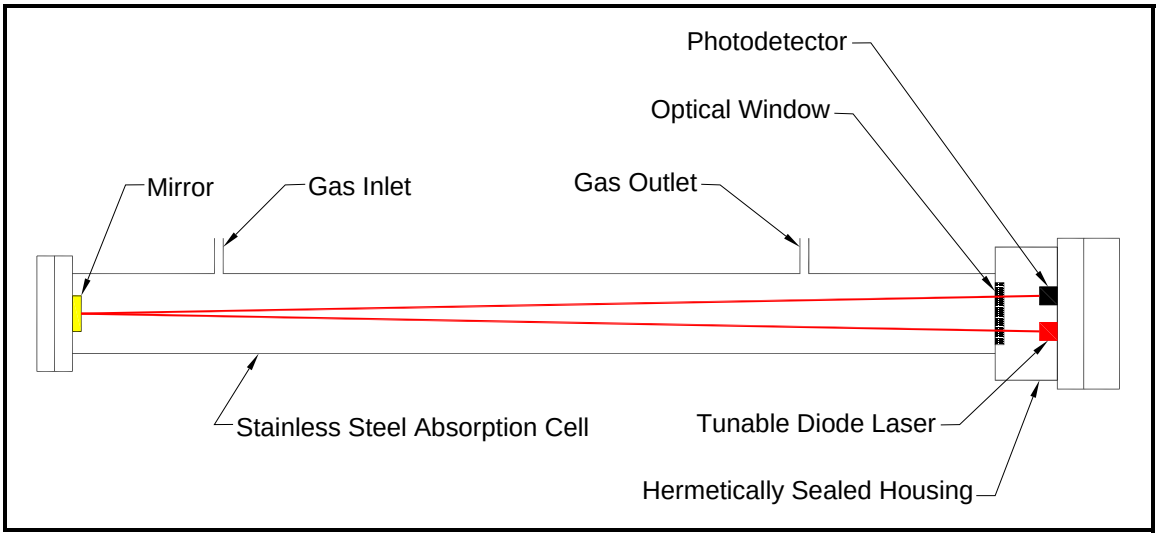


Figure 1: Laser Absorption Cell, Basic Elements

The control of the laser, power supply and signal conditioning circuitry are housed in an explosion-proof transmitter enclosure. A backlit, three-parameter, LCD display provides digital indication of user-programmable parameters. The **Aurora H2O** has three user-programmable (4-20 mA) analog outputs and two programmable digital ports that may be configured as either RS-485 or RS-232 with Modbus protocol. The analyzer has an auxiliary analog input (4-20 mA) input that is used for connection to an optional process pressure transmitter. Measurement of the process pressure enables the **Aurora H2O** to display and transmit the process dew point. **AuroraView** software is provided and enables remote readings, programming data logging and data logging with a personal computer.

The **Aurora H2O** hygrometer is calibrated against an NIST (or other national metrological institute) traceable reference dew/point generator and hygrometer. Each system is supplied with a certificate of calibration with functional test data.

1.4 System Components

Note: *Refer to* Table 1 on page 6 *for part descriptions.*

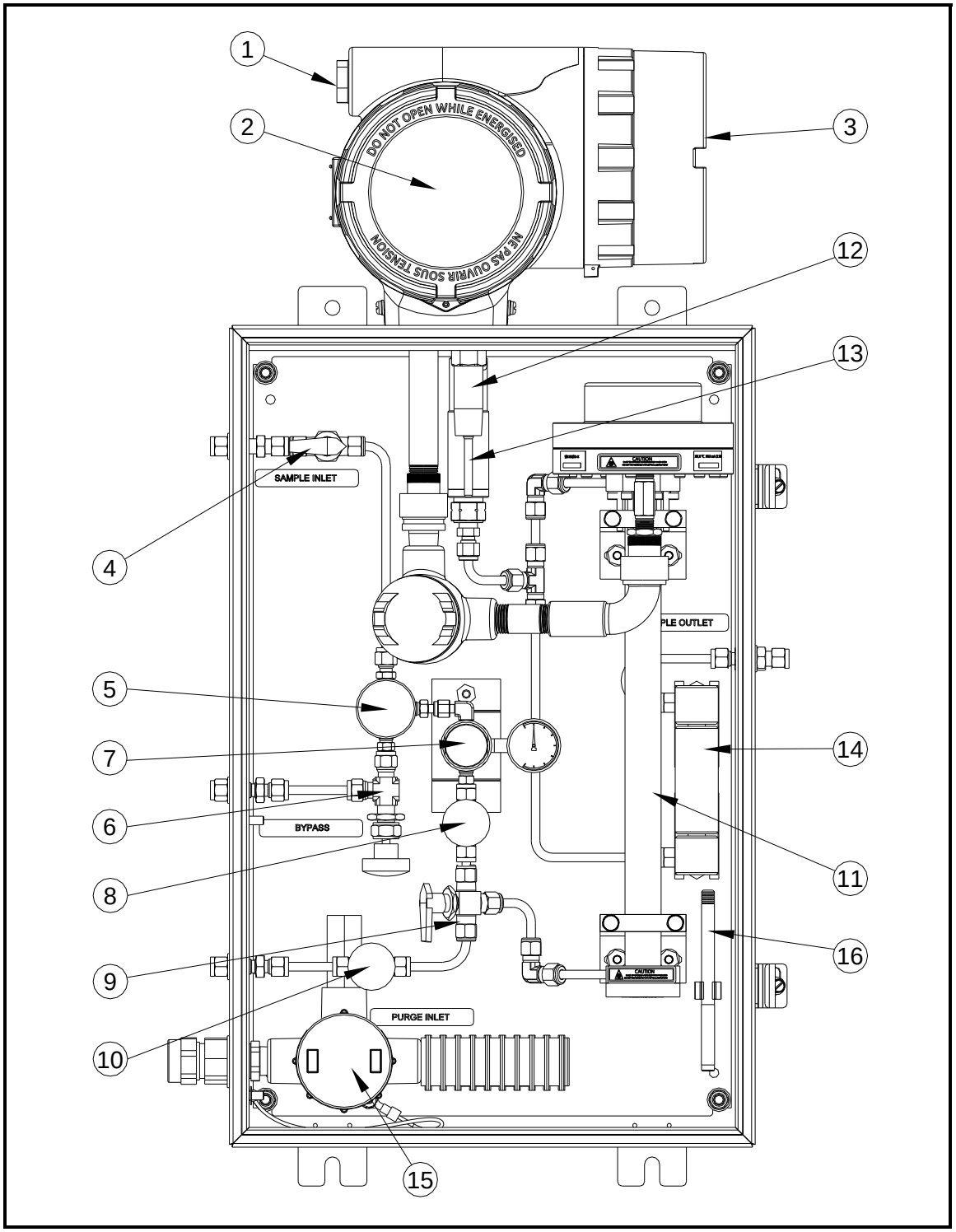


Figure 2: Aurora H2O System Assembly with Optional USA/CAN Heater

1.4 System Components (cont.)

Note: *Refer to* Table 1 on page 6 *for part descriptions.*

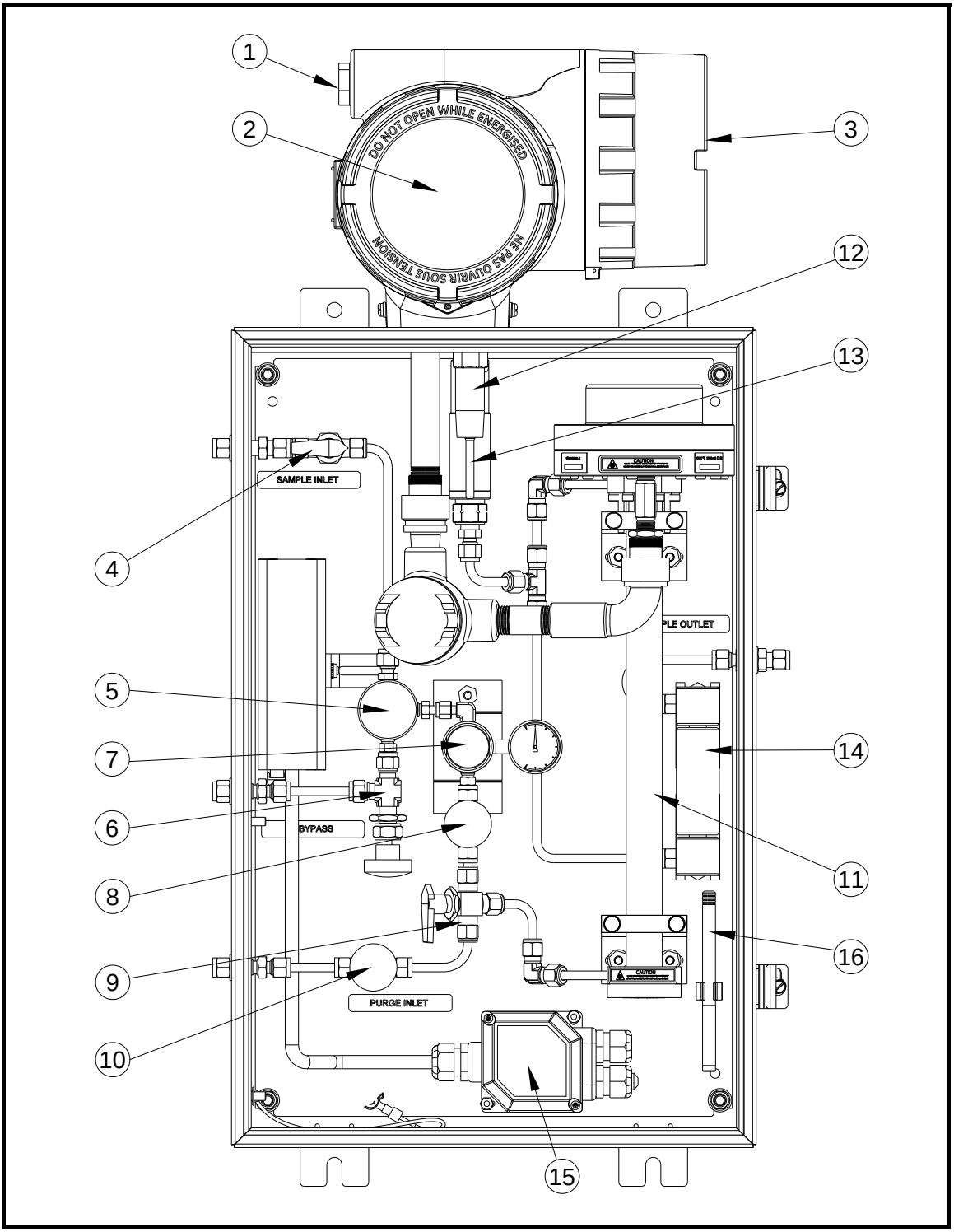


Figure 3: Aurora H2O System Assembly with Optional EU/ATEX Heater

1.4 System Components (cont.)

Table 1: Aurora H2O System Parts List

No.	Description	No.	Description
1	Conduit I/O	9	Process or Purge Gas Selector
2	Display and Magnetic Stylus Keypad	10	Purge Gas Inlet Needle Valve
3	Wiring Terminals	11	Absorption Cell
4	Isolation Valve (ball valve)	12	Temperature Sensor
5	Coalescing Filter	13	Pressure Sensor
6	Coalescing Filter Drain & Fast Loop Vent	14	Rotameter
7	Pressure Regulator w/ 0-10 psig outlet pressure gauge	15	Optional Heater, thermostat, junction box
8	Flow Control Needle Valve	16	Magnetic Stylus

1.4 System Components (cont.)

IMPORTANT: *The filter installed within the Aurora is designed to function as a secondary filter. A primary filter or filter train should be used upstream of the analyzer. Do not sample directly from the process gas to the Aurora without the use of a primary filter and pressure reduction. The pressure inlet to the Aurora sample inlet should not exceed 500 psig.*

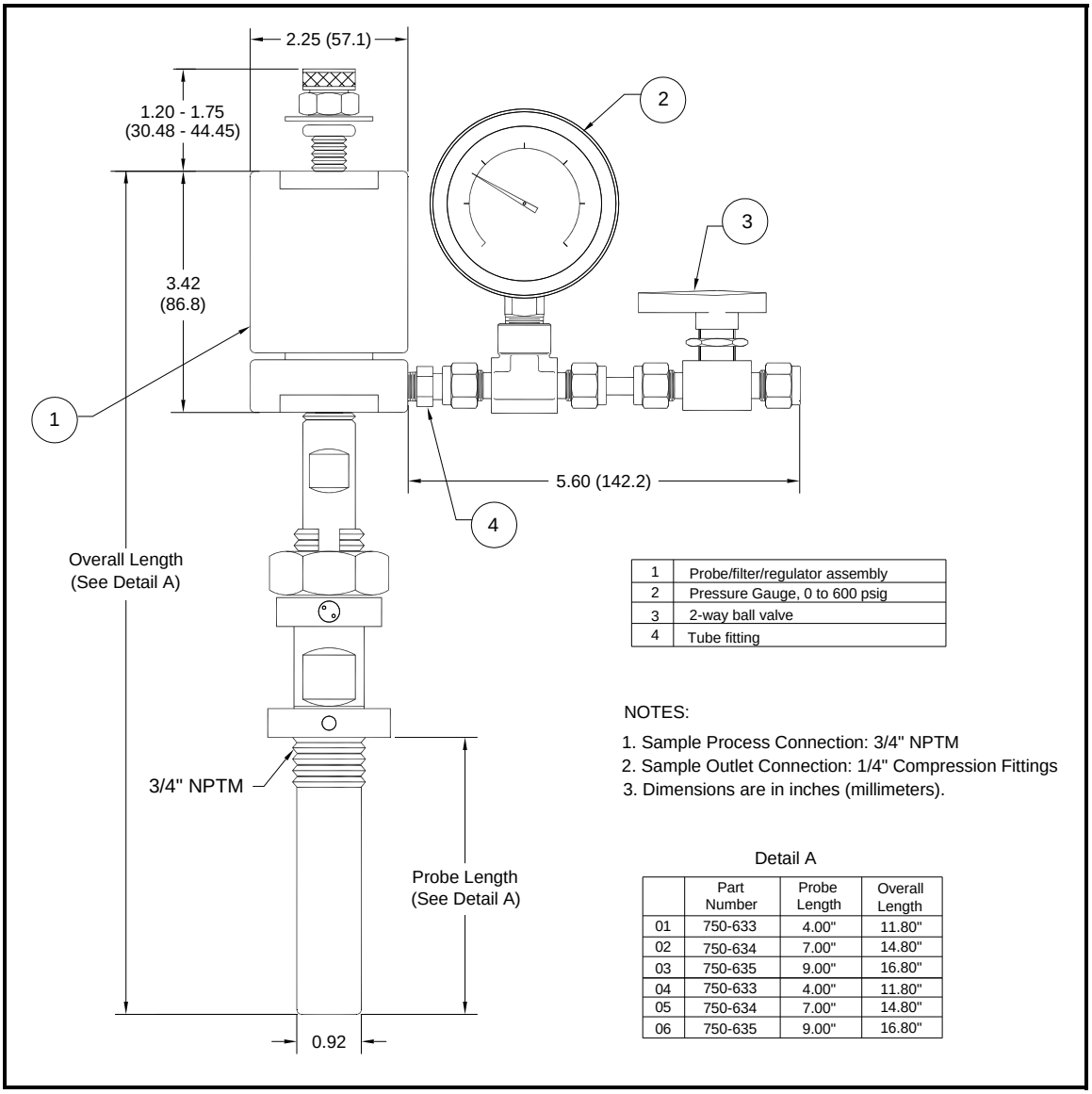


Figure 4: Sample System (ref. dwg #733-737)

For natural gas, a pipeline insertion membrane filter is recommended as shown in *Figure 4* above. The installation of the insertion filter is described in this manual. The insertion filter also is equipped with a pressure regulator which functions to reduce the pressure. If it is not possible to install the insertion filter, consult GE application engineers for information about a sample conditioning system.

1.4 System Components (cont.)

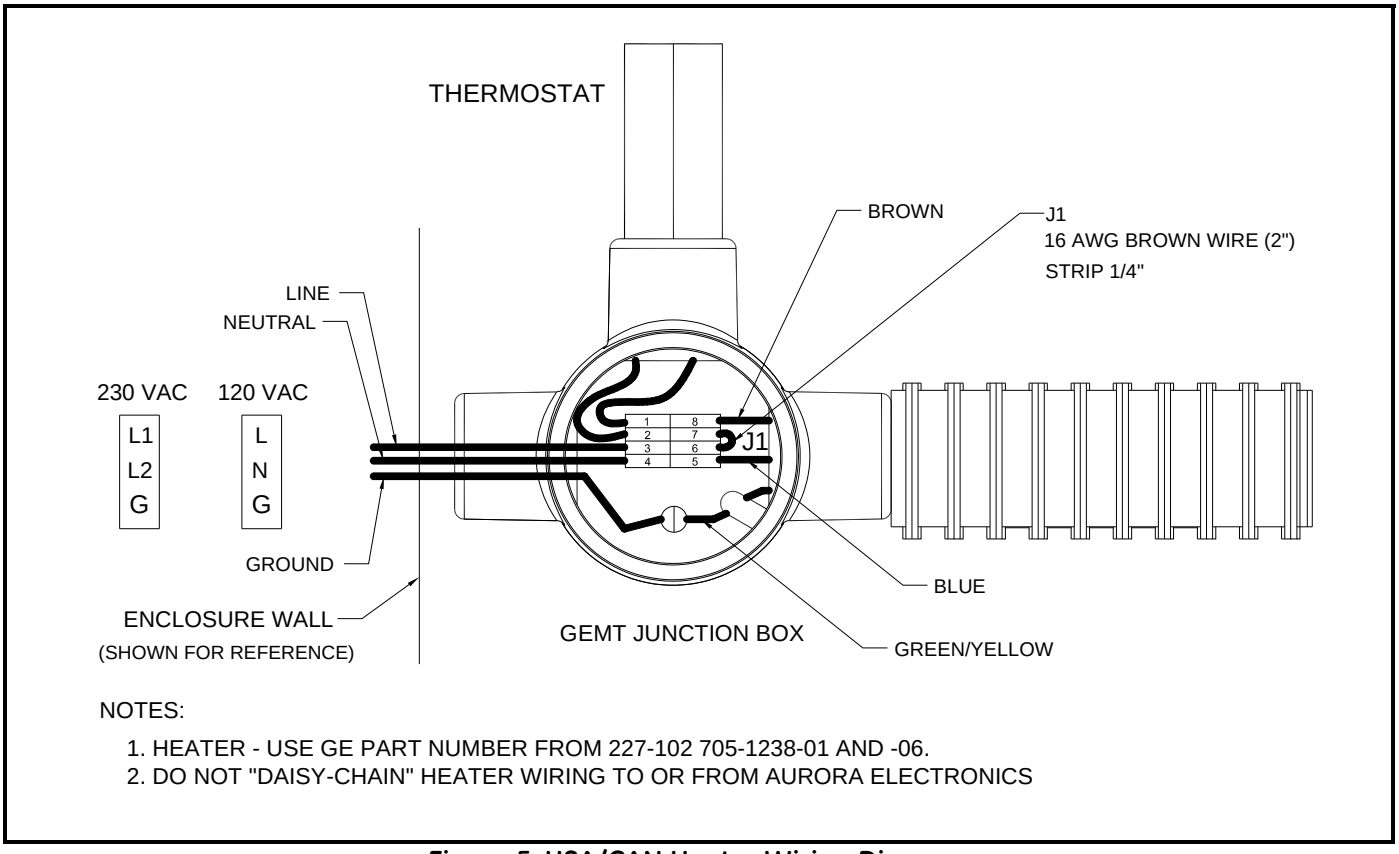


Figure 5: USA/CAN Heater Wiring Diagram

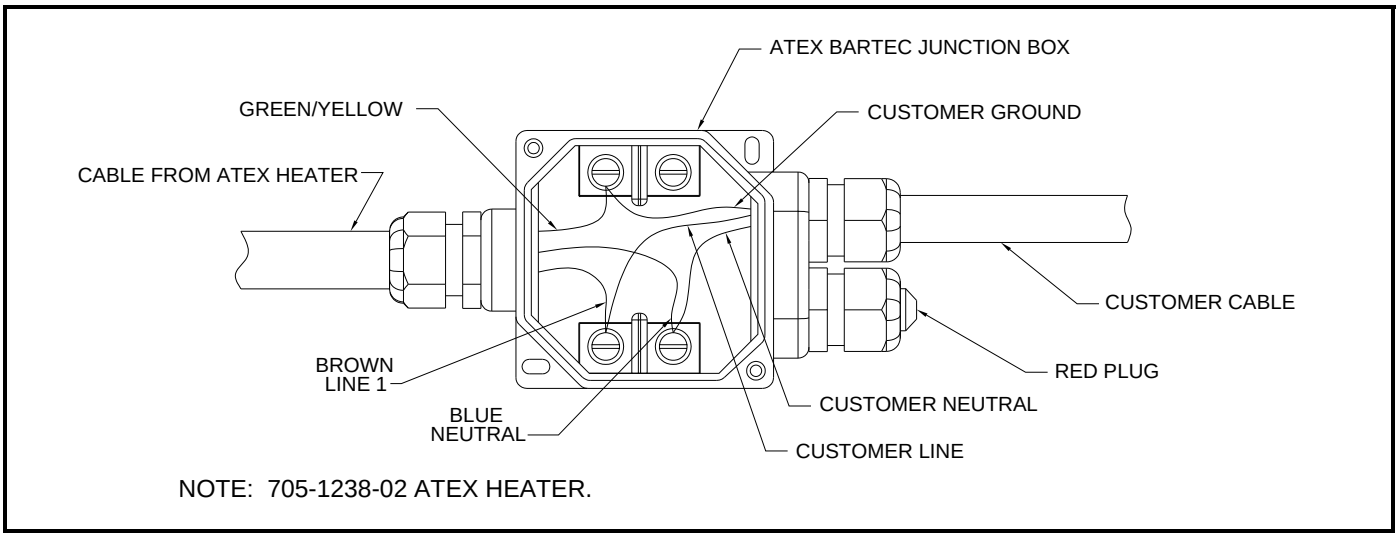


Figure 6: EU/ATEX Heater Wiring Diagram

1.5 Specifications

1.5.1 Power

Analyzer:
100-240 VAC, 50-60Hz, 10W
18-32 VDC (24 VDC nominal), 10W
Optional Electrical Heater:
120VAC, 120W
230VAC, 75W

1.5.2 Range

Part Per Million by Volume
5 to 5000 ppm_v

Dew/Frost Point*
–65.5°C to –2.6°C (–85.9°F to 27.3°F)

Process Dew/Frost Point*
Process or equivalent dew point/frost point by calculation with process pressure signal (4-20 mA) or constant
Absolute Humidity
3.8 to 3803 mg/m^3 (0.24 to 237 lbs/MMSCF)

*Readings below 0°C (32°F) are in “frost point” temperature, and above 0°C (32°F) are in “dew point” temperature.

1.5.3 Accuracy

Parts per Million by Volume
±2% of reading in ppm_v or 4 ppm_v (Accuracy of other parameters derived from ppm_v)

1.5.4 Response Time

Optical Response
<2 seconds
System Response
The system response is dependent upon the length of sample tubing, sample system components, flowrate and pressure, as well as the change in moisture concentration.

1.5.5 Operating Pressure

Operating Sample Cell Pressure:
69 to 172 kPa (10 to 25 psia)
Maximum Pressure
1380 kPa (200 psi)
Process Pressure
10,342 kPa (1500 psig) maximum [Higher pressure available using additional sampling system components]

1.5.6 Temperature

Operating
–20° to +65°C (–4° to 149°F)
Storage
–20° to +70°C (–4° to +158°C)
Optional Heater/Thermostat Setpoint
20°±5°C (68°±9°F) for U.S. and Canada
10°±5°C (50°±9°F) for EU and elsewhere

1.5.7 Flowrate

Sample Cell Flowrate
10 to 60 SLH (0.4 to 2 SCFH); 30 SLH (1 SCFH) nominal
Coalescer By-pass Fast Loop
5 to 10X of flowrate through sample cell

1.5.8 Display

Backlit LCD, three programmable simultaneous parameters, alphanumeric status and diagnostic display, LEDs for power, laser temperature stability, keypad lockout

1.5.9 Inputs/Outputs

Analog Outputs
Three programmable 0/4-20 mA, 500 Ω maximum load
Analog Input
Loop-powered 4-20 mA input for remote pressure transmitter (**Aurora H2O** supplies 24 VDC)
Digital Interface
Two programmable digital communications ports
RS-232 and RS-485 with multidrop capability and assignable address, Modbus RTU protocol

1.5.10 Enclosure

Ingress Protection
IP-66

1.5.11 Laser Certification

Class 1 product, conforms to IEC 60825-1 Edition 2.0, Safety of Laser Products

WARNING!
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser exposure.

1.5.12 User Interface

Programmable “through-the-glass” via magnetic stylus

1.5.13 Weight and Dimensions

Net Weight
45 kg (100 lb)
Overall Dimensions
34”H x 18”W x 14”D (87 cm x 46 cm x 36 cm) [see drawings]

1.5.14 Hazardous Area Certification

USA/Canada
Explosion-Proof for Class I, Division 1, Groups C&D
EU and Elsewhere
ATEX and IECEx: Ex de IIB T6; Tamb = –20°C to +65°C. Flameproof with increased safety compartment

1.5.15 European Certification

CE
Complies with EMC Directive 2004/108/EC, Low Voltage Directive 2006/95/EC and
Pressure Directive 97/23/EC for DN<25

1.5.16 Calibration

Recommended factory Verification/Service
Five years

1.5.17 Software

Displays all key parameters. Provides time-base graphing, data logging ability, export data as ASCII text. Software has lockout/passcode.

1.5.18 Sampling System

Integrated sampling system to filter out physical contaminants, remove glycol carry over, control temperature condition, regulate pressure and flow rate. Optional thermostatically controlled heater.

1.5.19 Wetted Components

316/316L stainless steel for tubing and fittings. Other wetted components such as the optical window and mirror are proprietary materials and are compatible with natural gas and typical contaminants found in natural gas. Other sample system components wetted parts include PTFE, PFA, Inconel, Hastelloy, PVDF, glass, Viton.

[no content intended for this page]

Chapter 2. Installation

2.1 Introduction

The **Aurora H2O** analyzer provides direct indication of moisture concentration in natural gas. Temperature and pressure sensors are used to provide high precision enhancement. It may be installed in a wide variety of environmental conditions, and meets the requirements for operation in hazardous areas.

Be sure that the ambient temperature is at least 10°C higher than the maximum dew/frost point temperature you expect to measure. This will ensure that you will not have liquid condensation in the sample transport line or the **Aurora H2O** sampling system components. Heat tracing the sample line will aid in elevating the sample temperature above the dew point. An optional heater installed within the enclosure is also available.

2.2 Bill of Materials

The following items should have been received with your shipment:

- **Aurora H2O** Unit
- **Aurora H2O** User's Manual on CD ROM
- **AuroraView** Software on CD ROM
- **Aurora H2O** Calibration Data Sheet
- Maintenance/Accessories Kit
- Optional: Pipeline Insertion Filter/Regulator Assembly

2.3 Unpacking

The **Aurora H2O** is shipped in a packing box with a plywood base (see *Figure 7* to the right), and the **Aurora H2O** analyzer is secured to the plywood base with mounting bolts. Transport the shipping package with the plywood base on the bottom, and according to the warning labels on the exterior packaging. Open the packing box from the top, and remove the foam packing material. Collect any separate components such as the **AuroraView** CD, the User Manual CD, and other items contained in the shipment.

Remove the mounting studs at the bottom of the enclosure. Using two people, lift the **Aurora H2O** from the bottom of the enclosure and from the top of the enclosure where the analyzer electronics is located. A typical **Aurora H2O** weighs approximately 100 pounds (45 kg). Use a proper lifting technique to avoid injury.

Check all the received components and record the model numbers and serial numbers for your records. If anything is missing, contact GE immediately.

Figure 7: Unpacking the Aurora H2O

2.4 Choosing A Site for Installation

You should have discussed environmental and installation factors with a GE Sales, Application or Service Engineer by the time you receive the analyzer.

Before installing the analyzer, read the guidelines below on installation recommendations:

1. Choose an installation site for the **Aurora H2O** analyzer as close to the actual sample point (sample take-off point) as possible, to minimize transport time to the analyzer.
2. Avoid unnecessarily long lengths of sample transport tubing to minimize transport time to the analyzer.
3. Avoid dead-legs in the sample transport tubing to minimize the possibility of liquid build-up.
4. Use stainless steel tubing. Avoid using copper tubing, as the water molecule has greater absorption capabilities for copper compared to stainless steel. Avoid rubber tubing at all costs, as water molecules interact with the rubber, and ambient moisture can permeate through the tube wall into the sample gas.
5. Mount the **Aurora H2O** analyzer at grade, or at a location that is easily accessible for maintenance (on a platform or other structure).
6. Be sure that the ambient temperature is at least 10°C higher than the maximum dew/frost point temperature you expect to measure. This will ensure that you will not have liquid condensation in the sample transport line nor in the **Aurora H2O**. Heat tracing the sample line will aid in elevating the sample temperature above the dew point. An optional heater installed within the enclosure is also available.

A typical **Aurora H2O** system for monitoring moisture off a natural gas pipeline is shown in *Figure 8 on page 15*.

2.4 Choosing A Site for Installation (cont.)

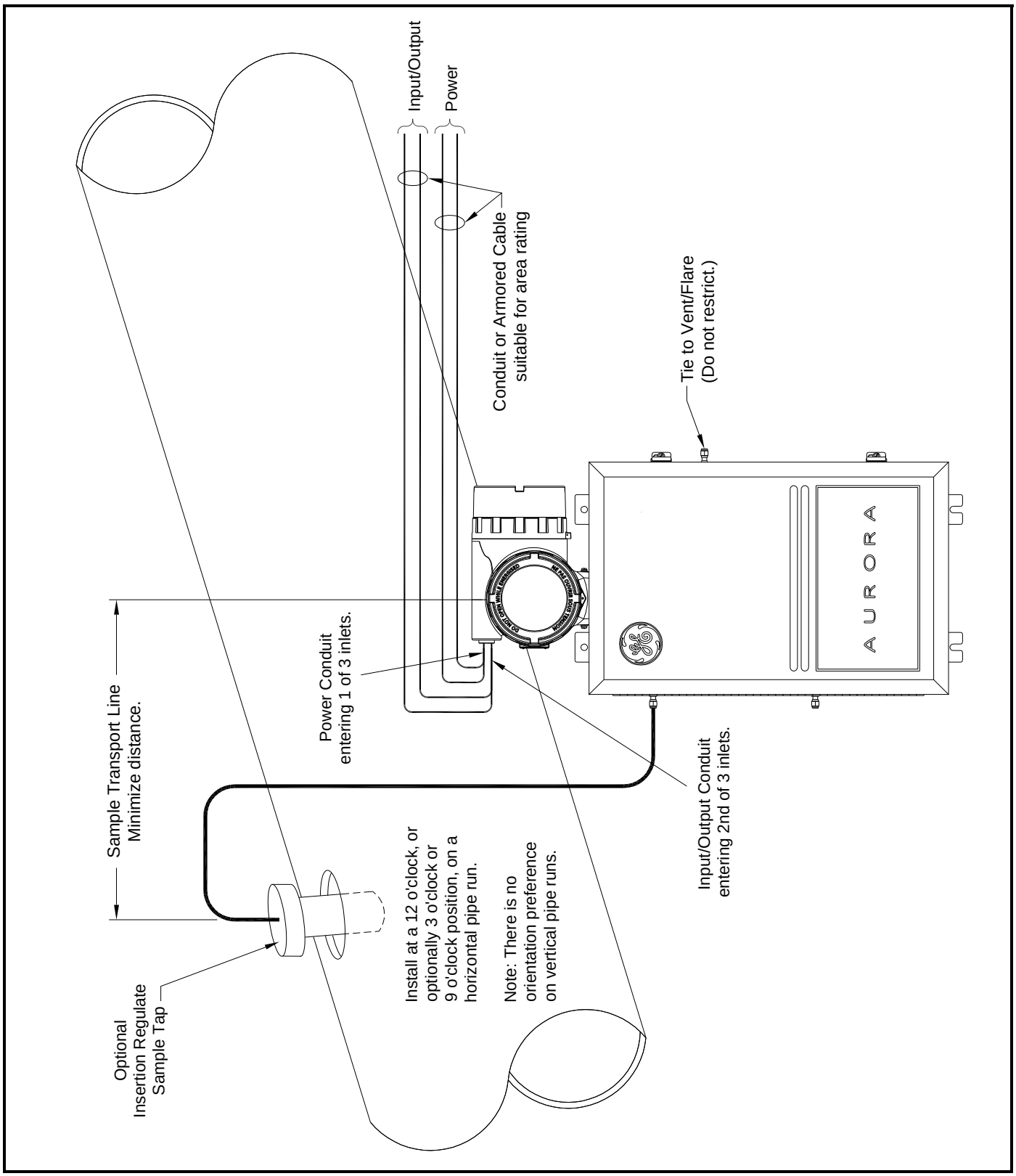


Figure 8: Aurora H_2O Analyzer Monitoring Moisture Off a Natural Gas Pipeline

2.5 Low Voltage Directive

To comply with the Low Voltage Directive, you must install a switch or circuit breaker on the input power line. For greatest safety, locate the circuit breaker or power switch near the electronics console.

IMPORTANT: *Installation must be done in accordance with the National Electrical Code, the Canadian Electric Code, and/or any other applicable local codes.*

2.6 Mounting

Use the four mounting tabs to mount the **Aurora H2O** System Assembly in the desired location (see *Figure 31 on page 31*).

IMPORTANT: *The* **Aurora H2O** *should only be mounted* vertically.

2.7 Optional Insertion Probe/Regulator

2.7.1 Description

For natural gas applications that may have entrained particulate and liquid contaminants (especially TEG carry-over from TEG dryers), GE recommends the use of a *Insertion Probe/Regulator* to serve as the first part of particulate and condensate filtration where the gas is sampled off the pipe. The device combines the features of a sample tap, a membrane filter and an integral pressure regulator (0-500psig outlet), adjustable at the sample take-off point. The sample tap housing includes a foot-valve so that, once installed, the assembly can be removed from a line under pressure for membrane filter replacement as needed.

Figure 9: Insertion Probe/Regulator

Note: *A 29/32" (0.907 inch, 23.1 mm) minimum bore-through clearance is needed on the customer nozzle for insertion of a 3/4" NPT insertion membrane liquid separator/pressure regulator.*

2.7.2 Installation

Note that the *Optional Insertion Probe/Regulator* can be installed only on depressurized lines. There is no hot-tap installation for this device.

This procedure is broken down into two steps:

- Installing the Housing
- Installing the Insertion Probe/Regulator Assembly

2.7.2a Installing the Housing

The housing, as shown in *Figure 10* below, is supplied with a *Locking Mechanism* to ensure that housing can only be removed intentionally.

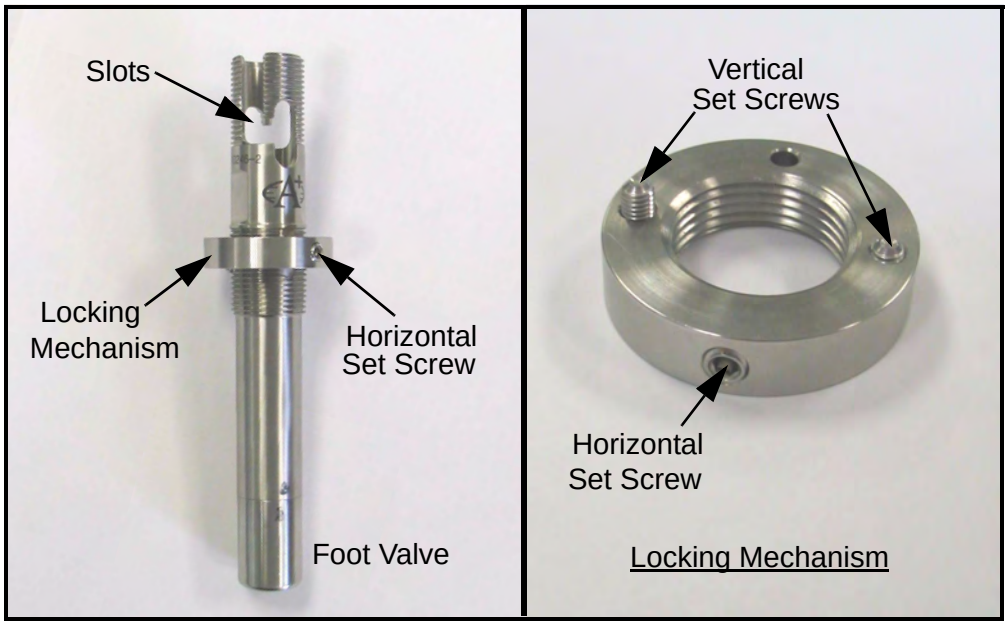


Figure 10: Installing the Housing and Locking Mechanism

1. Turn the locking mechanism counter-clockwise until it is at its extreme upper position. Apply thread sealant to the threaded area below vertical slots in the threads. Do not allow the thread sealant to enter the slot, as it may interfere with the mechanism.

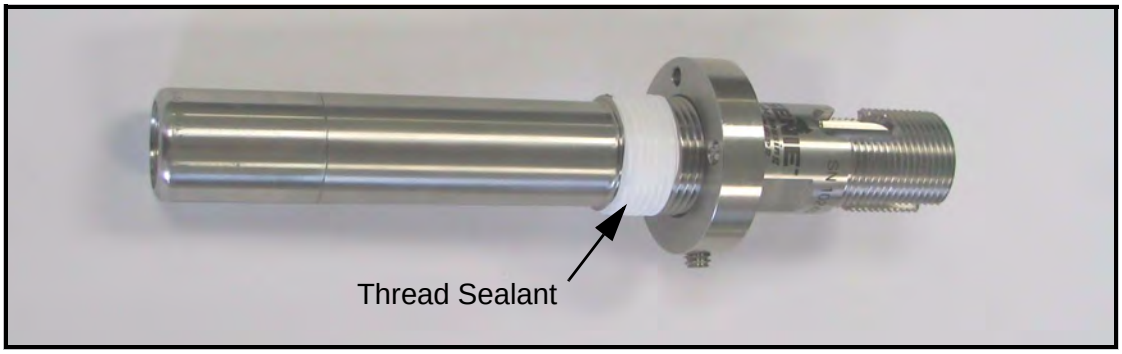


Figure 11: Applying Thread Sealant

2.7.2a Installing the Housing (cont.)

2. Confirm that the pipeline has been depressurized. Insert the housing into the pipeline through a ¾" NPTF thread-o-let (The minimum ID of the thread-o-let is 0.91").

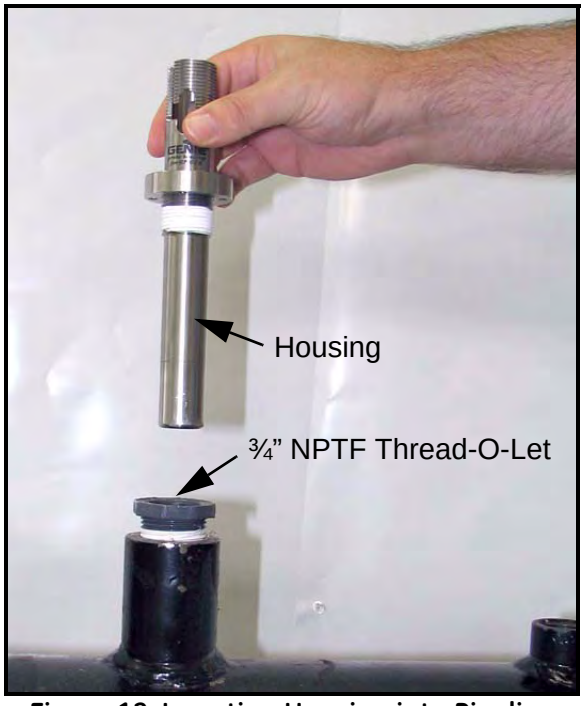


Figure 12: Inserting Housing into Pipeline

3. Using a wrench on the wrench flats, turn the housing until it is secure and sealed. This will require between three and five turns. **DO NOT OVERTIGHTEN**! The housing may be damaged if it is over-tightened, causing the housing to deform.

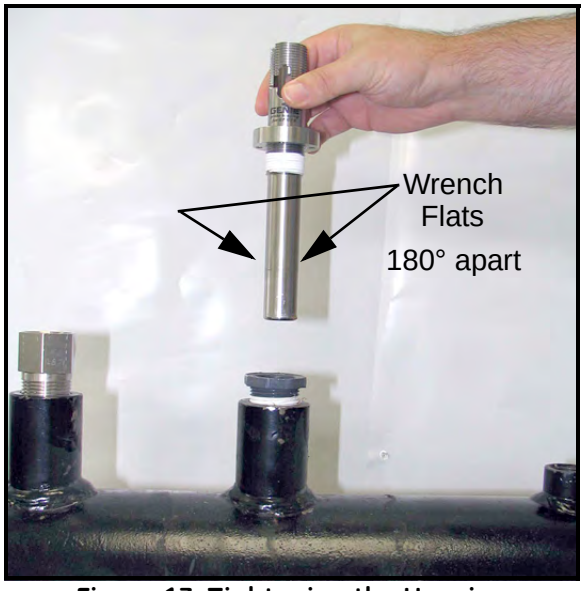


Figure 13: Tightening the Housing

2.7.2a Installing the Housing (cont.)

4. Turn the locking mechanism clockwise until it first touches the top of the thread-o-let.

5. Turn the locking mechanism counterclockwise until the Allen screw is aligned with the thread slot. Using a 1/8” Allen wrench, tighten the Allen screw until its tip is tight against the slot. **DO NOT OVERTIGHTEN THE ALLEN SCREW** as this will cause the housing wall to be indented.

Figure 14: Aligning and Tightening the Allen Screw

6. Using a 3/32” Allen wrench, tighten the Allen screws on the locking mechanism's surface until their tips are firmly set into the thread-o-let’s upper surface.

Figure 15: Tightening the Allen Screws

The housing is now installed. The locking mechanism should prevent the housing from becoming unintentionally unscrewed from the thread-o-let. The pipeline my now be pressurized.

2.7.2b Installing the Insertion Membrane Liquid Separator/Pressure Regulator Assembly

1. Confirm that the allen cap screw head's hex cavity is clean and free from foreign material. Confirm that the allen cap screw that holds the membrane ferrule is torque-wrench tight. The torque value should be 10 inch-lbs. If the allen cap screw is only hand-tight, the screw may protrude excessively, which could result in foot valve actuation when the probe is installed into the housing.

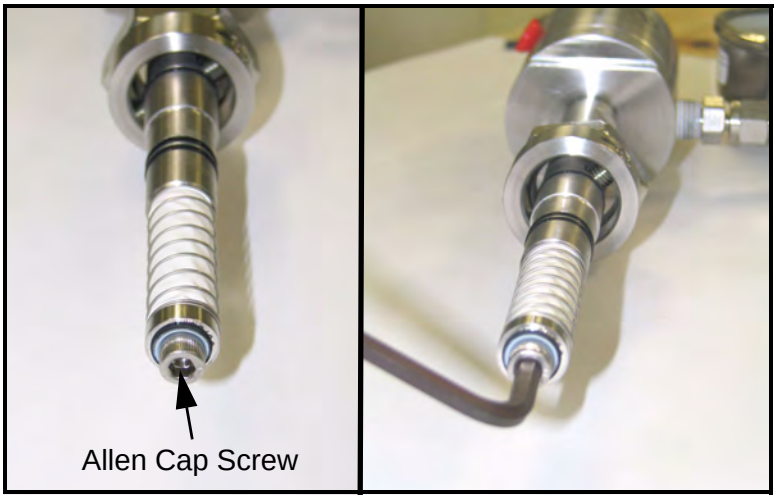


Figure 16: Checking/Tightening the Allen Cap Screw

2. Rotate the pressure adjustment screw on the pressure regulator fully counterclockwise until it rotates freely. Close the isolation ball valve.

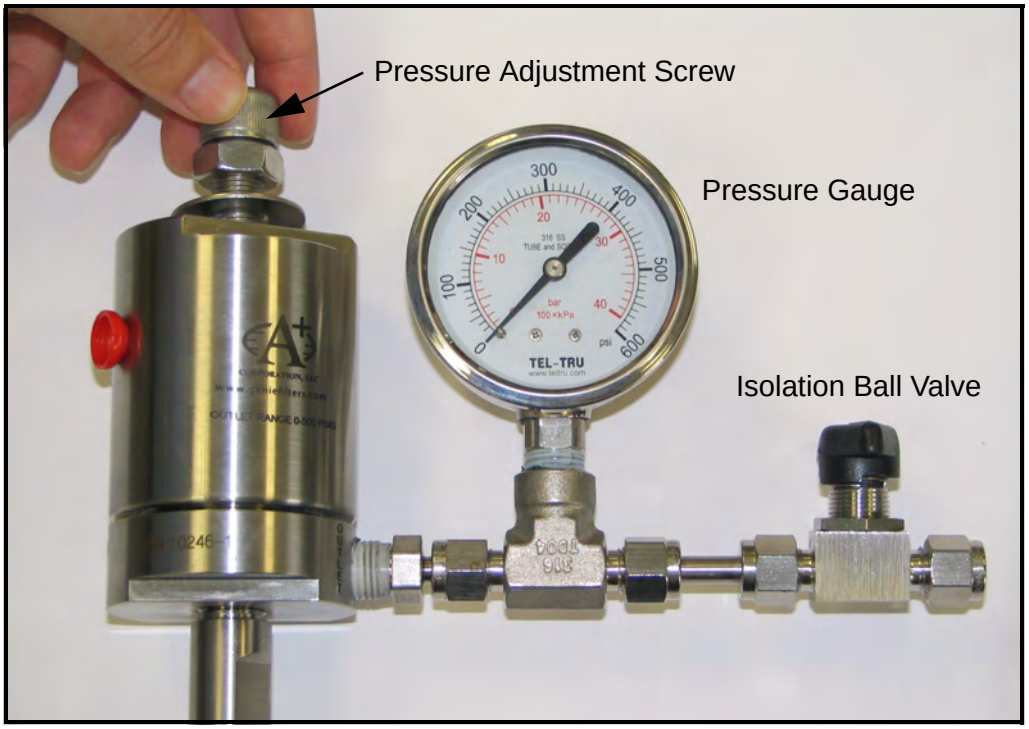


Figure 17: Rotating the Pressure Adjustment Screw

2.7.2b Installing the Insertion Membrane Liquid Separator/Pressure Regulator Assembly (cont.)

3. Position the membrane end of the probe above the installed housing. Slowly lower the probe into the housing. Avoid membrane contact with the upper section of the housing. DO NOT APPLY DOWNWARD FORCE. The probe should slide easily into the housing. Lower the probe only enough to thread the insertion nut one complete turn of thread engagement.

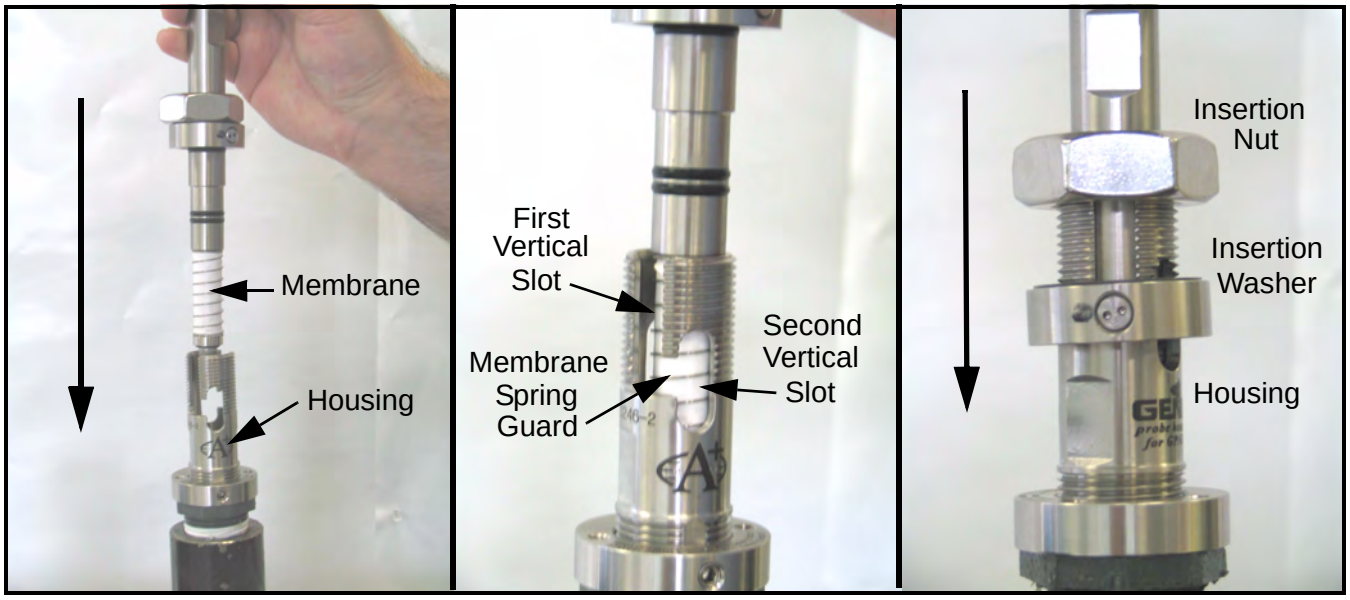


Figure 18: Installing the Probe

4. Thread the insertion nut down by hand, lowering the probe until the insertion washer pins slide to the bottom of the first vertical slot.

Note: *The threaded nut on the housing ensures that if all other safety procedures are disregarded, it is mechanically impossible to remove the probe.*

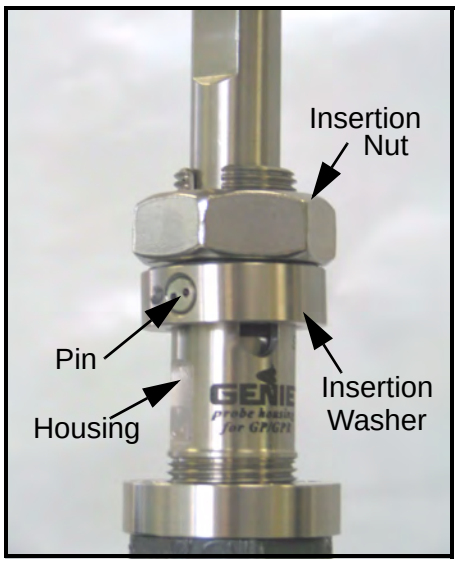


Figure 19: Threading the Insertion Nut

2.7.2b Installing the Insertion Membrane Liquid Separator/Pressure Regulator Assembly (cont.)

5. Rotate the probe counterclockwise until the pins are to the far right in the horizontal slot. At this point, the probe is sealed against the housing interior wall. The pins will be in the middle of the second vertical slot.

Figure 20: Rotating the Probe

6. Loosen the insertion nut until it is above the top of the second vertical slot. The probe should not rise to the top of the second vertical slot. If the probe rises in the slot, the foot valve o-ring may have been damaged or attacked by the process.

Note: *The threaded nut on the housing ensures that if all other safety procedures are disregarded, it is mechanically impossible to remove the probe. Perform the next step regardless of the status of the foot valve o-ring.*

Figure 21: Loosening the Insertion Nut

2.7.2b Installing the Insertion Membrane Liquid Separator/Pressure Regulator Assembly (cont.)

7. Tighten the insertion nut by hand until it is against the insertion washer again. Using a wrench, tighten the insertion nut against the insertion washer so that the pins are at the bottom the second vertical slot. At this point the foot valve opens and the insertion process is complete.

Figure 22: Tightening the Insertion Nut

2.7.3 Setting the Pressure

Note: *Perform these steps only after the entire system has been plumbed, including the* **Aurora H2O**.

1. Ensure the inlet sample gas isolation valve on the **Aurora H2O** sample system is closed. Open the isolation ball valve at the *Optional Pipeline Insertion Membrane Liquid Separator/Pressure Regulator.*
2. Turn the pressure adjustment screw clockwise to increase the pressure. The optional pipeline insertion membrane liquid separator/pressure regulator is the FIRST STAGE pressure reduction of the system when used. Depending upon your source pressure, you should step down the pressure to a value in the range given in *Table 2* below.

Table 2: Pressure Settings

Source Pressure	Outlet Pressure Setting
750 psig < source < 1500 psig	400-500 psig
500 psig < source < 750 psig	300 psig
< 500 psig	50% of the average source pressure

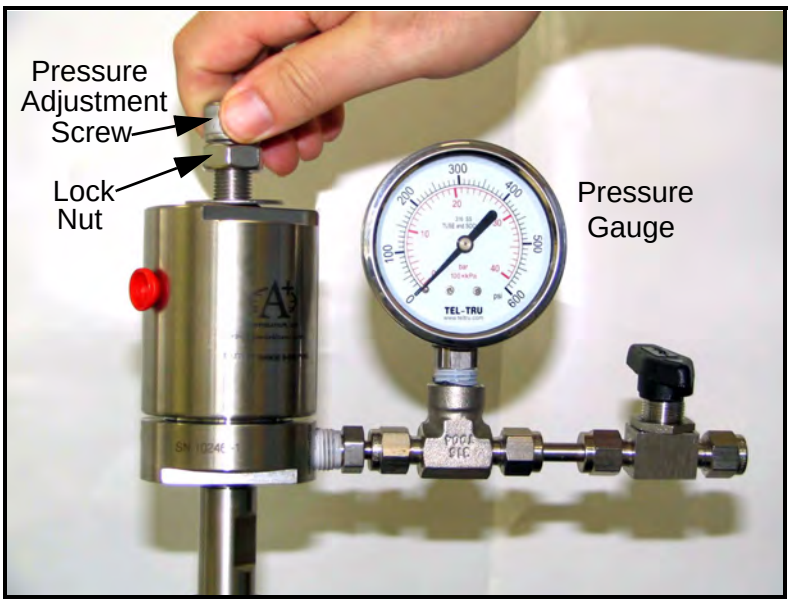


Figure 23: Turning the Pressure Adjustment Screw

3. Tighten the lock nut down to the top of the pressure regulator to avoid future possible changes in pressure regulator setting, once the pressure is set.

2.8 Making Electrical Connections

Refer to *Figure 32 on page 32* for wiring connections.

1. **Aurora H2O** has three ¾" NPT conduit inlet ports for power and I/O. These will normally be shipped plugged from the factory. Follow the applicable wiring code and requirements for wiring the unit.

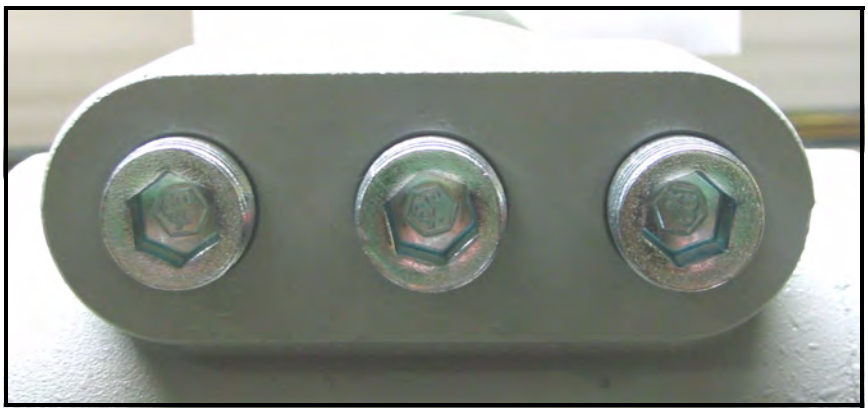


Figure 24: Conduit Inlet Ports

Note: *Use one conduit inlet for power. Use the two other conduit inlets for input/output as needed. All unused conduit inlet ports should be sealed with suitable blanking elements.*

2. Select one conduit for inlet power to the **Aurora H2O** based on your configuration. The **Aurora H2O** comes with a universal power supply, or optionally, as a 24VDC powered unit. Remove the wiring cover to view the wiring terminal block.

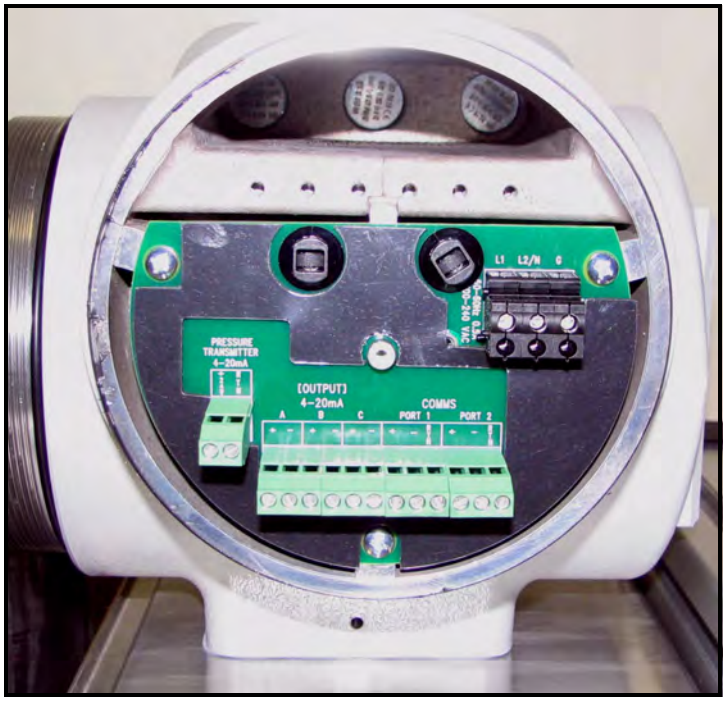


Figure 25: Wiring Terminal Blocks

2.8 Making Electrical Connections (cont.)

Note: *Supply connection wiring shall be rated at least 10°C above the rate maximum service temperature of 85°C, be stripped back 5/16 in. (8 mm) and torqued to a minimum of 4.4 in. lb. (0.5 Nm).*

3. Run the AC power connections to the Power Terminal Block shown in *Figure 26* below. It is recommended to use 12-18 AWG (3.3 - 0.82 mm^2) power wiring.

Figure 26: Power Terminal Block

4. Use wiring conduit runs, separate from the **Aurora H2O** main power, for all I/O (Input/Output) leads. Wire up to three 4-20mA outputs to the terminals labeled A, B, and C. The three analog outputs A, B and C (0-20mA or 4-20mA) are internally powered by the **Aurora H2O**. Use shielded 18-22 AWG (0.82–0.33 mm^2) twisted pair wire, and ground the shield at one end only. Wire up digital communications to Port 1 and/or Port 2 as labeled.

5. Either digital port may be configured for RS-232 or RS-485. Port 1 is designated as "SCADA." Port 2 is designated as "SERVICE." For operation on RS-485, 2-wire, half-duplex bus, attach the RS-485(+) to (+), and the RS-485(–) to (–). Make no connection to RTN.

Note: *For an RS-485 Multidrop Network, a terminating resistor must be installed across the* **Aurora H2O** *RS-485 terminals, or an internal terminating resistor can be applied. See below.*

- When using the **Aurora H2O** in RS-485 mode, and to prevent signal reflections on the high-speed RS-485 connections, it is recommended that the far end of the RS-485 lines be terminated properly. The termination can be accomplished in one of two ways:

  — Connect 120Ω ¼W leaded resistors across the + and – terminals of ports 1 and 2 (both ports or whichever one will be in use),

  or

  — Using long-nose pliers, move jumpers J15 and J16 from pins 2 and 3 (default setting from factory) to pins 1 and 2 (see Figure 27 on page 28). J16 is the termination for port 1 and J15 is the termination for port 2. It is also recommended that basic ESD precautions such as grounded wrist straps be used for this procedure.

2.8 Making Electrical Connections (cont.)

Multi-drop RS-485:

For multiple **Aurora H2O** units connected in daisy-chain fashion to the RS485 interface, it is important that the farthest unit away from the transmitting device be the only unit incorporating any termination (see *Figure 27* below). All other units must have jumpers J15 and J16 in positions 2 & 3 (default setting from the factory). For more details on RS-485 wiring or operation, refer to TIA/EIA-485-A Specification.

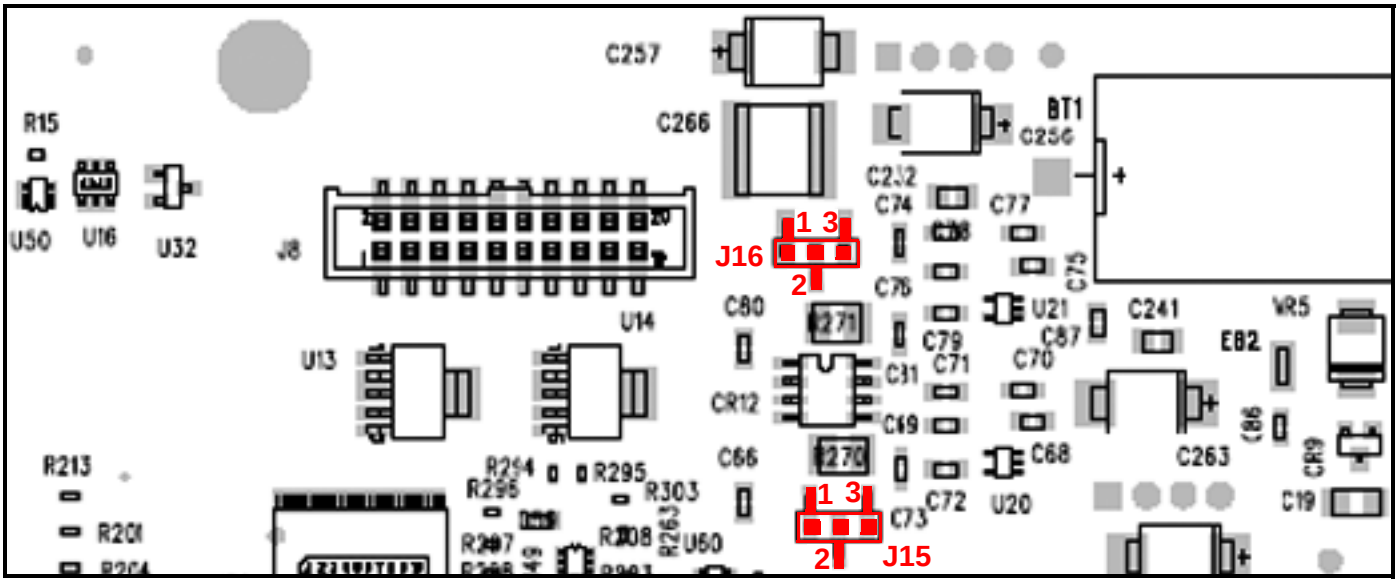


Figure 27: RS-485 Mode Termination - Install Jumpers at J15 and J16, Pins 1 and 2

Note: *Terminations are NOT required when using ports in RS-232 mode.*

- For operation on RS-232, connect RS-232(TXD) to (+), RS-232(RXD) to (–), and RS-232(GND) to RTN (see *Figure 28* below).

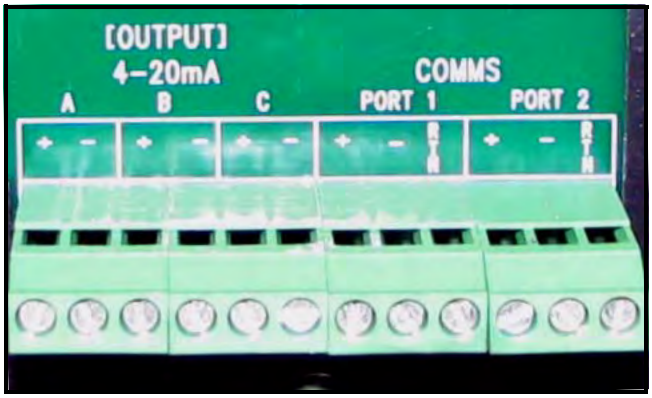


Figure 28: Input/Output Connections

2.8 Making Electrical Connections (cont.)

6. For connection to a PC to interface with **AuroraView** software, you may use the supplied 704-688 cable (RS-232 w/ SUB-D-9 connector to tinned leads). Wire the cable as follows:

Color Code		Aurora H2O Terminal
White	Tx	+
Red	Rx	–
Green	Ground	RTN

Note: *The default configuration is as shipped:*

BAUD Rate:	115,200
Parity:	Even
ID Note:	1 for Port 1, 2 for Port 2

7. Use a separate wiring conduit run for any 4-20mA pressure transmitter input. This input is used when a live input pressure reading for the main process pressure is desired, to determine an equivalent dew point by the **Aurora H2O** analyzer. Wire the 4-20mA pressure transmitter to the Pressure Transmitter terminal block (see *Figure 29* below). The **Aurora H2O** supplies 24VDC for use with a loop-powered, 2-wire pressure transmitter.

Figure 29: Pressure Transmitter Connections

IMPORTANT: *Use of an external pressure transmitter is not covered by the* **Aurora H2O** *hazardous area certifications. The external pressure transmitter should be suitably rated for the area classification. Its associated wiring should be done in accordance with local codes and regulations, and suitably rated for the area classification.*

8. If the **Aurora H2O** has been supplied with an optional electrical heater, there are two possible configurations: USA/CAN or EU. Connect the AC power using a separate conduit from the power for the **Aurora H2O** analyzer. The heater is equipped with a thermostat preset to 25°C (77°F) nominal. Use 12-18 AWG (3.3 - 0.82 mm^2) wires. The heater terminals are located within a junction box (item 15 in *Figure 2 on page 4* or *Figure 3 on page 5*).

2.8 Making Electrical Connections (cont.)

9. Lastly, the **Aurora H2O** analyzer requires a connection to ground from the electronics explosion-proof/flame-proof enclosure. There are two external ground connections available for the user (on the left and right hand sides of the enclosure). Wire this connection to earth ground, local to the **Aurora H2O** analyzer installation site.

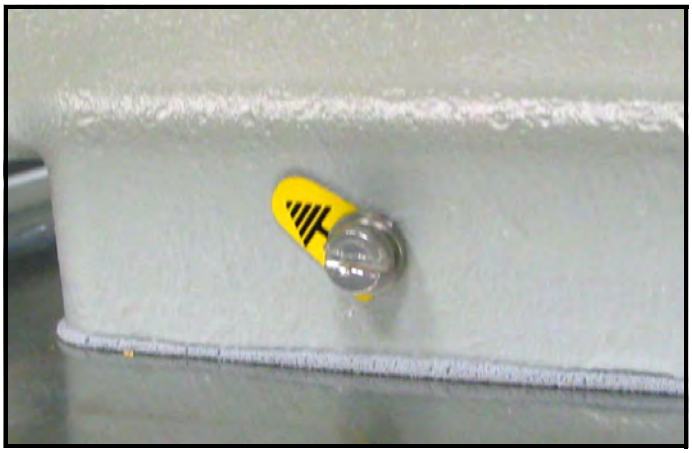


Figure 30: Earth Ground Connection

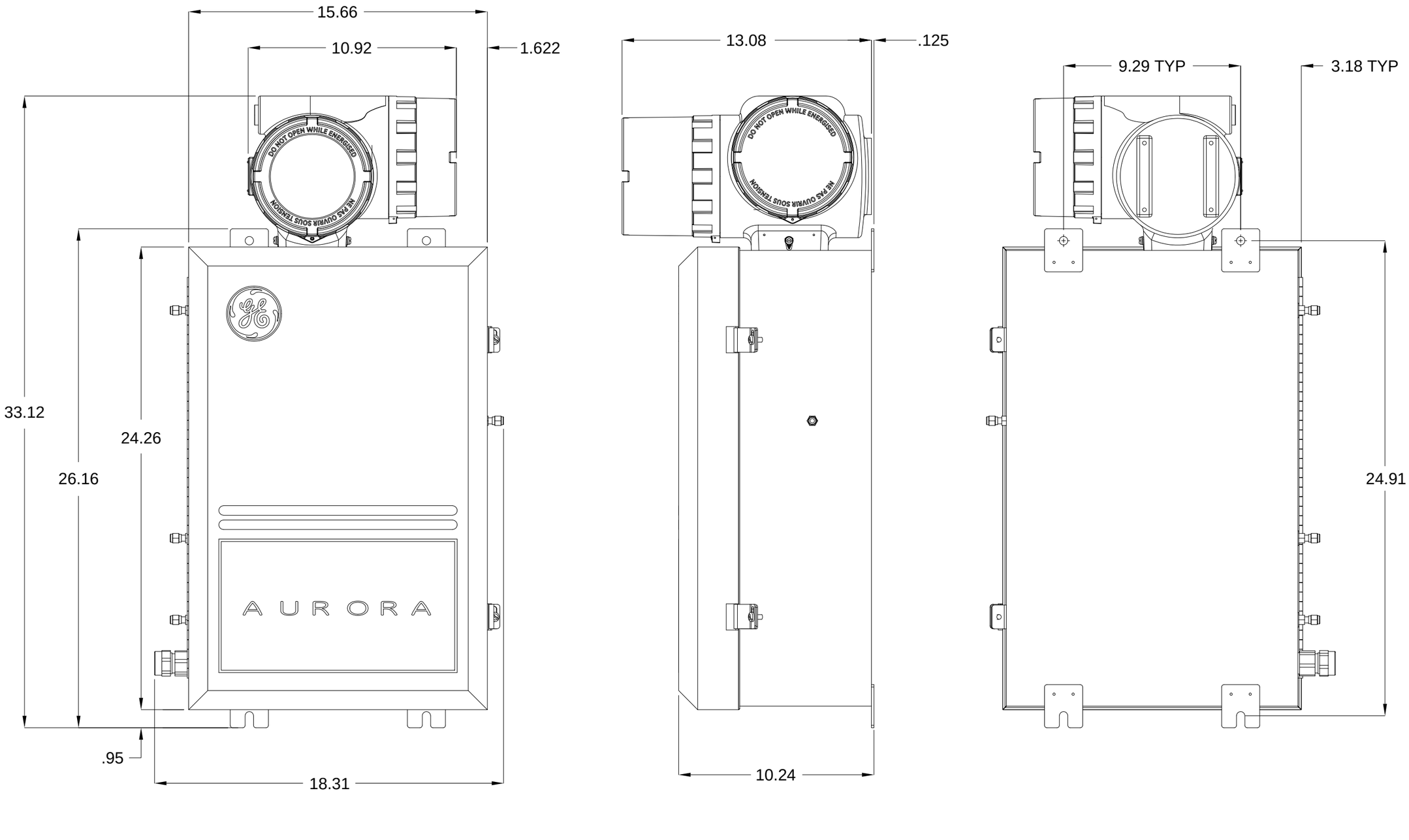


Figure 31: Aurora H2O Outline and Mounting (ref. dwg #712-1456)

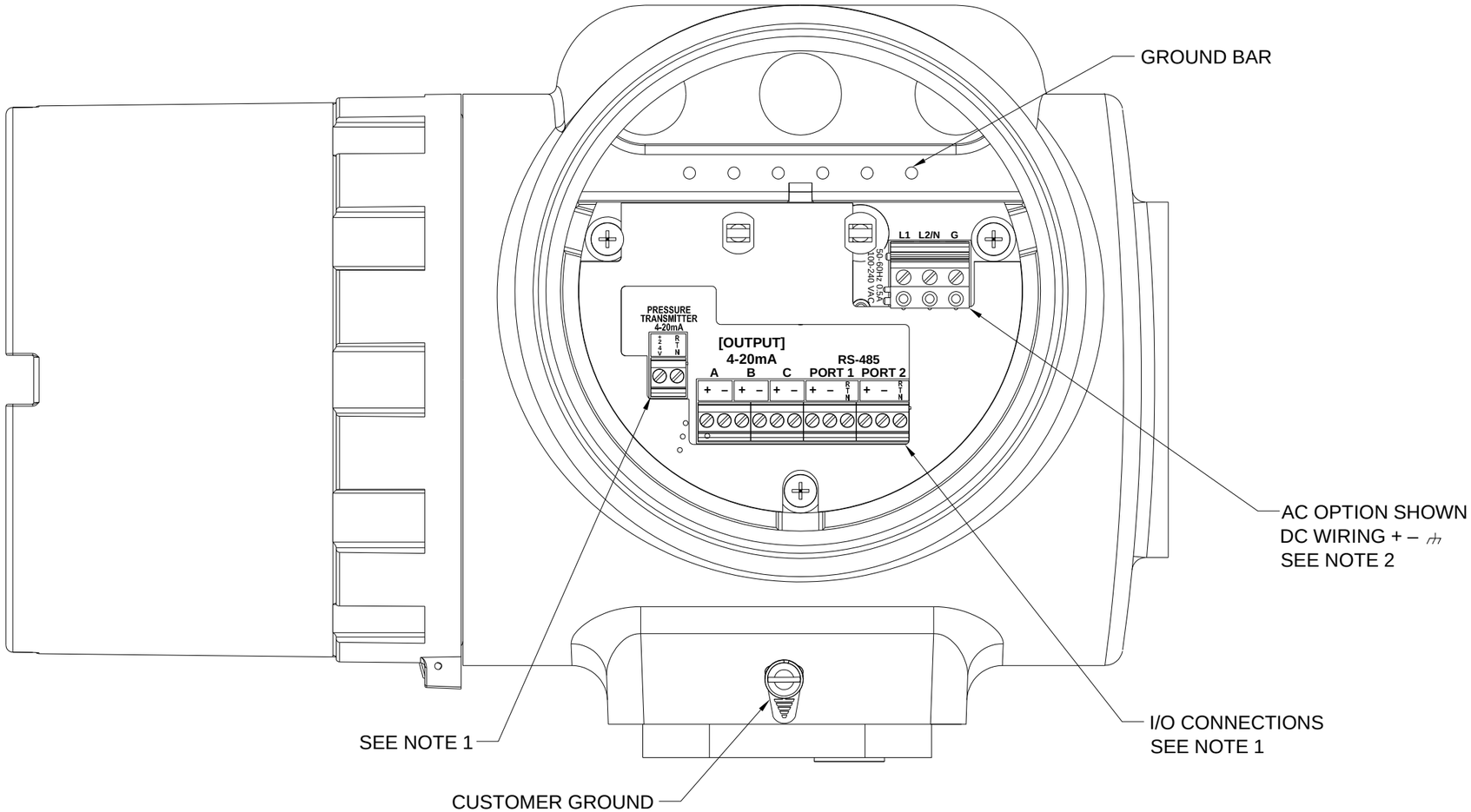


Figure 32: Aurora H2O Electronic Assembly Wiring Diagram (ref. dwg #702-8976)

NOTES:

1. I/O CONNECTIONS AND PRESSURE TRANSMITTER WIRE GAUGE RANGE 12-24 AWG.
2. AC AND DC CONNECTION WIRE GAUGE RANGE 12-18 AWG.

Chapter 3. Operation and General Programming

3.1 Using the Aurora H2O

Follow the information in this chapter to operate the **Aurora H2O** system.

CLASS 1 LASER PRODUCT

WARNING! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser exposure.

3.2 Sample System

See the instructions below and *Figure 33 on page 34* to operate the **Aurora H2O** sample system.

3.2.1 Startup

1. Start with all valves in closed position and the pressure regulator turned fully counter-clockwise.
2. Turn the Sample/Purge 3-way ball valve to point towards the sample needle valve.
3. Sample Inlet gas pressure should be <400 psig (2760 kPa).
4. Confirm that there are no pressure restrictions downstream of the sample outlet flowmeter.
5. Open the inlet isolation ball valve.
6. Crack the bypass valve ¼ turn to establish coalescer bypass flow (fast loop). Establish a flow rate of approximately 10x the sample flow through the bypass (10 SCFH/5 LPM nominal). The gas from this vent can be piped to a process or flare.
7. Turn the pressure regulator clockwise until the pressure gauge reads approximately 3-5 psig.
8. Open the sample needle valve until the flowmeter reads 30 SLPH (1 SCFH).

3.2.2 Shut Down

1. Close the inlet isolation ball valve.
2. Turn the pressure regulator fully counter-clockwise.
3. Close the sample needle valve.
4. Close the bypass needle valve.

3.2.3 Purge

1. Hook up the purge gas.
2. Regulate the pressure externally to 3-5 psig.
3. Turn the sample/purge 3-way ball valve towards the purge inlet.
4. Crack the purge inlet needle valve to set the to 30 SLPH (1 SCFH).

3.2 Sample System (cont.)

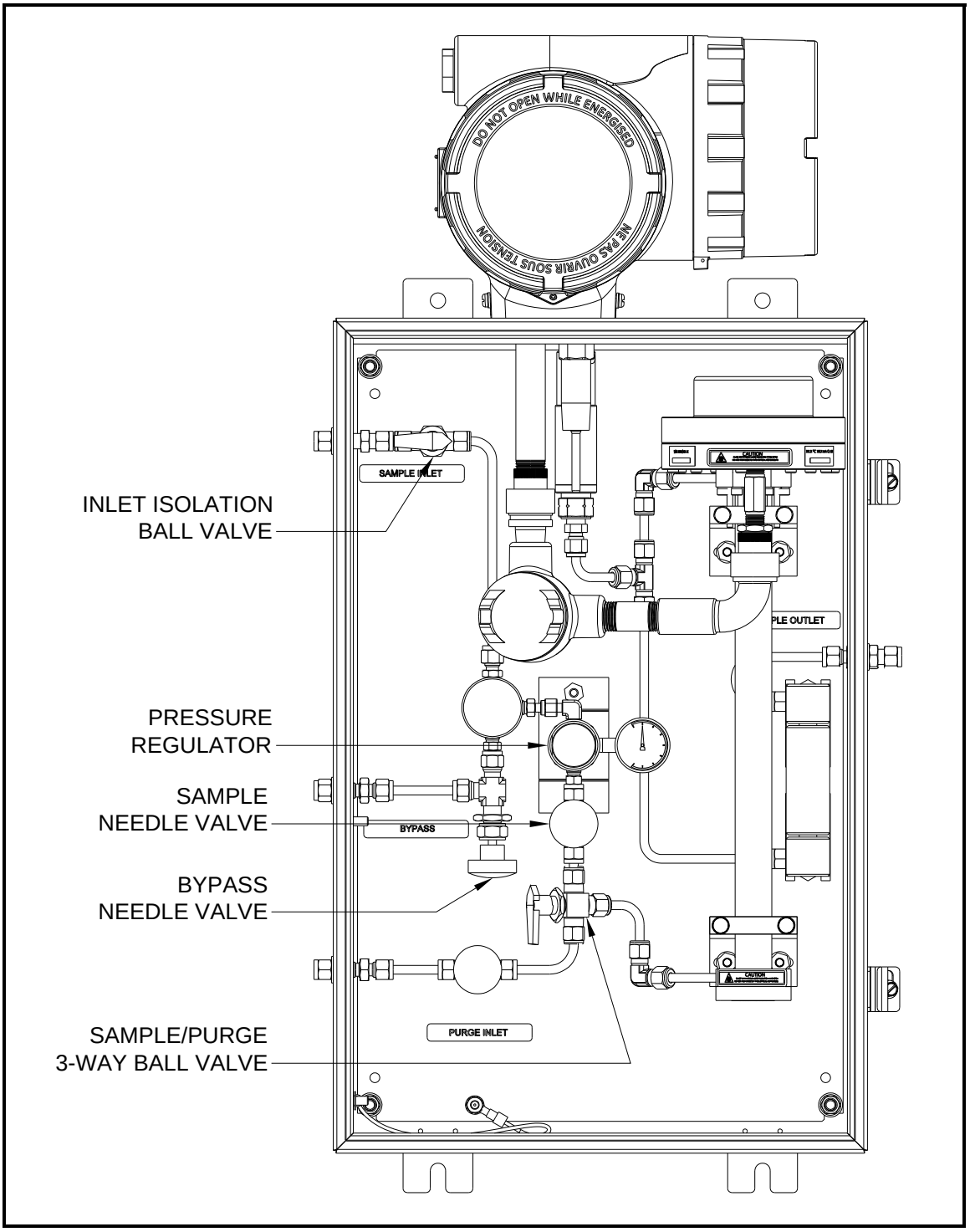


Figure 33: Aurora H2O Sample System Quick Startup Guide (ref. dwg #902-004)

3.3 Keypad Features

Figure 34: Aurora H2O Keypad

The **Aurora H2O** has seven keys: a **Menu** key, four **Arrow** keys, a **Cancel** ✘ key, and an **Enter** ✓ key.

- Use the **Menu** key to open the main menu on the display.
- Use the **Arrow** keys to navigate among menu choices and to increment/decrement numeric entries.
- Use the **Cancel** ✘ key to cancel a numeric entry change, or exit a menu.
- Use the **Enter** ✓ key to accept a numeric entry or select a menu option.

3.3.1 Indicator Lights

If the **Fault Indicator** is lit, an instrument fault is detected. A message will be displayed in the Main Display, top/right.

If the **Information Indicator** is lit, the instrument is still operating, but a message will appear in the Main Display top/right, with information about the instrument.

The **Keypad Lock Indicator** will be lit if either: A) the Keypad Lock-Out Switch, internal to the instrument, has been engaged, or B) the instrument keypad has not been used for a period of several minutes, engaging a software feature to lock-out inadvertent key usage. Type (B) keypad lock-out is overcome by pressing **Cancel**, **Enter**, **Cancel** in sequence.

If the **Laser Indicator** is lit, the laser is powered and operating normally. This indicator will be off if there is a laser-specific fault. This indicator will also be off for a brief period when the instrument is first powered. After initial power-up, this indicator may blink several times as the laser temperature is stabilized. The laser indicator will be lit constantly in normal operation.

The **Power Indicator** is normally lit when the instrument is powered.

3.3.2 The Magnetic Stylus

Each of the keys can be selected using a hand-held magnet called a *Magnetic Stylus* (see *Figure 35* below), which is included with the meter. By touching the clear window at a key location, that key will be selected and will flash a red light to verify the contact.

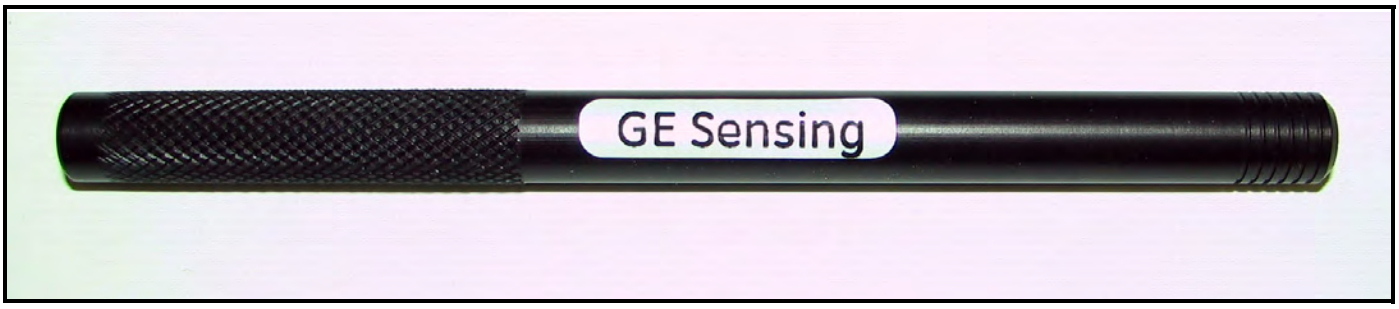


Figure 35: Magnetic Stylus

3.3.3 The Default Display

Figure 36 below shows the default display of the **Aurora H2O** window.

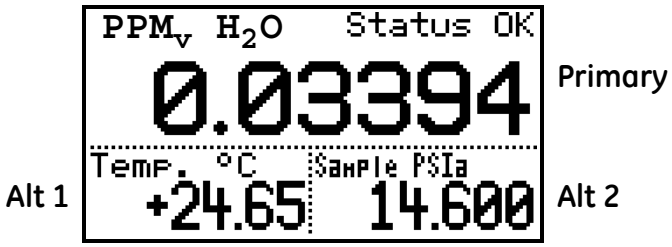


Figure 36: Default Display

3.3.4 Unlocking the Keypad

After power-on, the **Aurora H2O** keypad is locked as indicated by the symbol , lit up with a red backlight. It is necessary to enter the keypad unlock sequence to make any changes to the **Aurora H2O**.

Similar to a mobile phone, the **Aurora H2O** will prompt the operator to unlock if any key is pressed. A passcode is required to use certain factory service features only.

To unlock the keypad, press **Cancel** ✘, **Enter** ✓, **Cancel** ✘ in sequence.

3.3.5 Keypad Lock-Out Switch

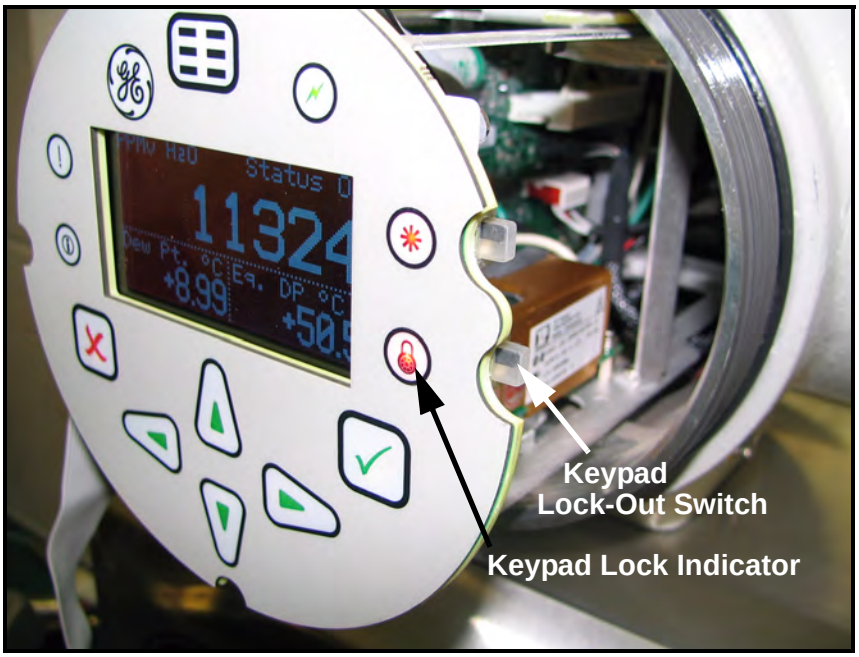


Figure 37: Keypad Lock-Out Switch Location

Note: *If the* Keypad Lock-Out Switch *is in the "down" position (towards the* **Aurora H2O** *sample system), the keypad is locked out and the* **RED** LED *on the* Keypad Lock Indicator *is on all the time.*

WARNING! **Do not open or remove the cover with the power on, unless the area is non-hazardous.**

3.3.6 Accessing the Menus

After successfully unlocking the keypad, press the ☰ Menu key. The **Aurora H2O** will display the Main Menu (see *Figure 38* below). Use the arrow keys to highlight the menu item desired. Refer to *Menu Map, Figure 73 on page 93*.

Press **Enter** ✓ to select the highlighted item. Many menu items will display another menu. Use **Cancel** ✗ to return to the previous menu page. Pressing **Cancel** ✗ from the Main Menu will return the screen to the Measurement Display.

Note: *Menu items displayed with an ellipsis (shown as a series of three dots after the menu item) will bring up more choices, while those without take immediate action.*

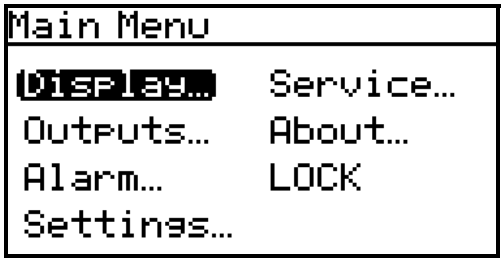


Figure 38: Main Menu

3.3.7 Entering Numeric Values

Since the **Aurora H2O** has no numeric keypad, numeric values are entered using a *"combination lock"* style of entry:

Use the **left** ◀ and **right** ▶ arrow keys to select the digit to change. The digit selected will be indicated with a ▲.

Use the **up** ▲ and **down** ▼ arrow keys to increment or decrement the digit.

Note: *If incrementing or decrementing a digit would cause the numeric value to exceed its allowable range (maximum/minimum value), the digit will not change.*

Press **Enter** ✓ to save the new value and return, or **Cancel** ✗ to return, leaving the original value intact.

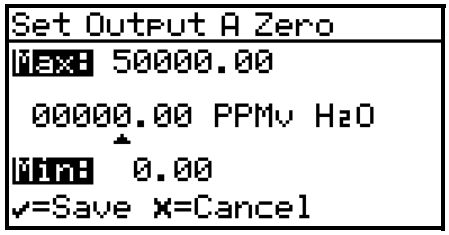
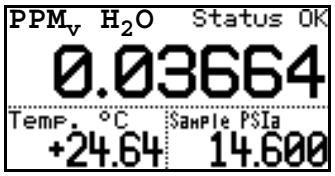


Figure 39: Numeric Entry

3.3.8 Starting Up

After proper installation, the **Aurora H2O** Transmitter can be set up to accommodate the user's requirements. Typically, the user may need to configure the analog outputs, trim the analog outputs, and program the digital outputs. Refer to the Menu Map, Figure 73 on page 93, and complete the following steps. Upon startup, the **Aurora H2O** proceeds through several displays until a screen similar to the following appears:



After startup, the screen will need to be unlocked. To unlock the screen, select

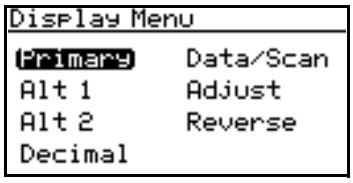
✘ ✓ ✘
Cancel, Enter, Cancel

Note: *In most instances; use the* **Enter** *key to save an entry and/or move ahead to the following screen; use the* **Cancel** *key to reject an entry and/or return to the previous screen.*

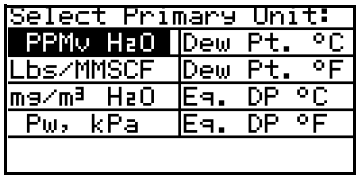
3.4 Setting Up the Display

When the screen is unlocked, touch the **Menu** key and the Main Menu appears with several options. To set up the display, select Display... and press **Enter**. The following screen appears:

3.4.1 Selecting Primary Units

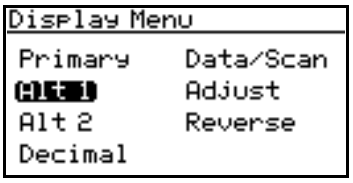


To select units for the primary display, select Primary and press **Enter**. The following screen appears:

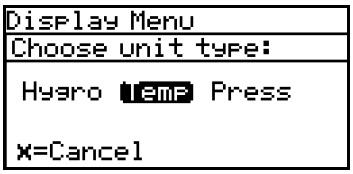


Use the arrow keys to highlight the desired units and press **Enter**. The screen returns to the Display Menu.

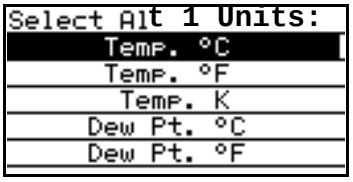
3.4.2 Selecting Alt 1 and Alt 2 Units



To set the units for Alt 1 and/or Alt 2, use the arrow keys to highlight the one to be set, and press **Enter**. The following screen appears:

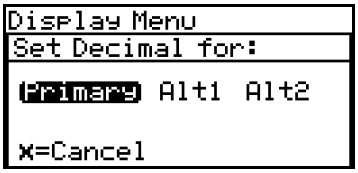


Use the arrow keys to highlight the desired unit type (Hygro, Temperature or Pressure) and press **Enter**. If Temp is selected, the following screen appears.



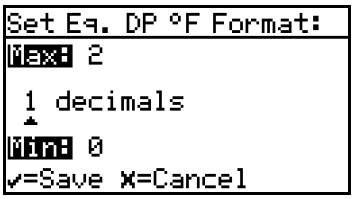
Use the arrow keys to highlight the desired unit and press **Enter**. The screen returns to the Display Menu. Use the same procedure to change other units.

3.4.3 Setting Decimal Places



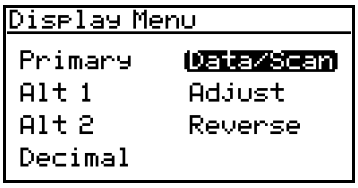
To set the decimal places for unit values, from the Display Menu use the arrow keys to highlight Decimal and press **Enter**. Then select the type of display and press **Enter**.

The decimal places setting determines the number of digits displayed for the value to the right of the decimal symbol ("**.**"), if possible.

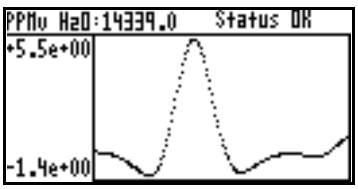


Use the arrow keys to change the number of decimal places and press **Enter**, or press **Cancel** if no changes are necessary. The screen returns to the Display Menu.

3.4.4 Data/Scan

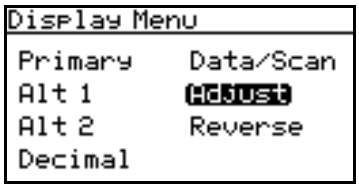


To toggle the display between showing the numeric values (data), and a graphic plot of the 2f waveform (scan), from the Display Menu use the arrow keys to highlight Data/Scan and press **Enter**. A screen similar to the following appears.

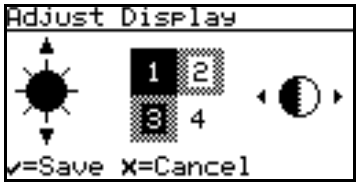


Note:*The scan can be used for diagnostic purposes when a PC with* **AuroraView** *is not readily available.*

3.4.5 Adjust

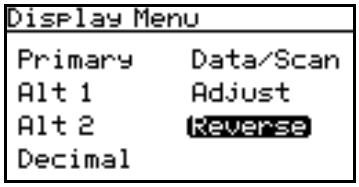


To modify the display contrast and brightness, from the Display Menu use the arrow keys to highlight Adjust and press **Enter**. The following screen appears.

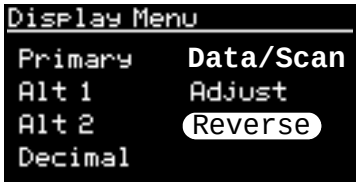


Use the Up/Down arrow keys to increase/decrease display brightness. Use the Right/Left arrow keys to increase/decrease display contrast. Press **Enter** to save the changes, or press **Cancel** to return to the previous setup. The screen returns to the Display Menu.

3.4.6 Reverse



To reverse the text and background shades, from the Display Menu use the arrow keys to highlight Reverse and press **Enter**. The following screen appears.

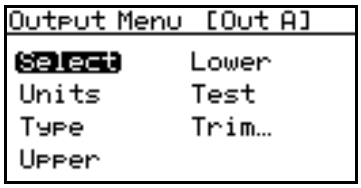


To return to the previous shade setup, select Reverse and press **Enter**. The previous screen appears.

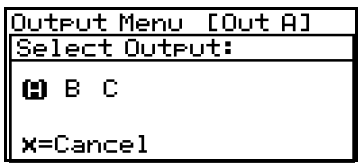
3.5 Setting Up Outputs

3.5.1 Selecting an Output for Setup

To set up outputs, from the Main Menu choose Outputs... and press **Enter**. The following screen appears.

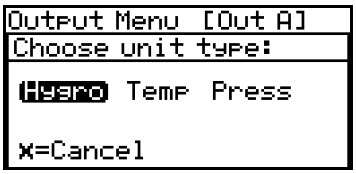


From the Output Menu choose Select and press **Enter**. The following screen appears.

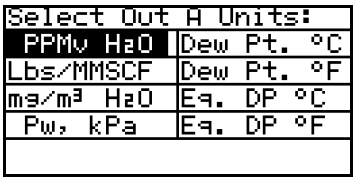


Use the arrow keys to select the output (A, B or C) to be set up, and press **Enter**.

3.5.2 Selecting Output Units

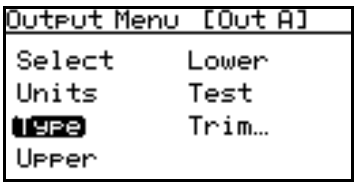


From the Output Menu, select Units and press **Enter**. Use the arrow keys to select the unit type and press **Enter**. A screen similar to the following appears:

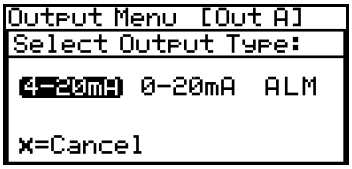


Use the arrow keys to select a new unit. Press **Enter** to save (or **Cancel** to keep the previous value), and return to the Output Menu.

3.5.3 Selecting an Output Type



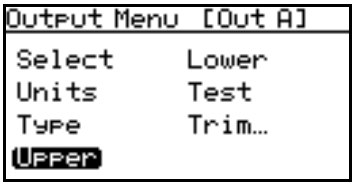
To change the output type, from the Output Menu select Type and press **Enter**. A screen similar to the following appears:



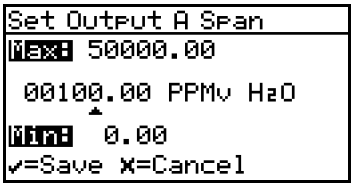
Use the arrow keys to select a new output type. Press **Enter** to save (or **Cancel** to keep the previous value), and return to the Output Menu.

Note: *If the* ALM *option is selected in the above menu, the analog output will function as an alarm indicator. In this mode, the analog output will remain at 0 mA during normal operating conditions, but the analog output will be driven to 24 mA whenever there is an alarm condition.*

3.5.4 Changing the Upper Output Span

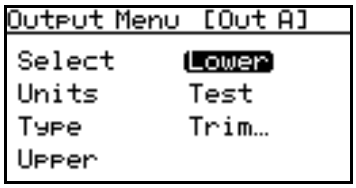


To adjust the upper output span, from the Output Menu select Upper and press **Enter**. A screen similar to the following appears.

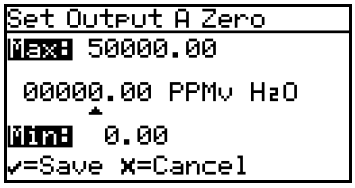


Use the left and right arrow keys to select each digit to be changed and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep the previous value), and return to Output Menu.

3.5.5 Changing the Lower Output Span

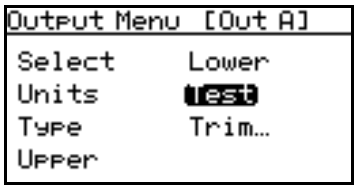


To adjust the lower output span, from the Output Menu select Lower and press **Enter**. A screen similar to the following appears.

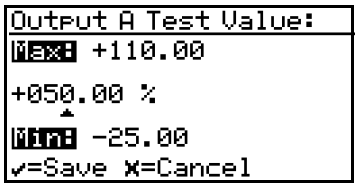


Use the left and right arrow keys to select each digit to be changed and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep the previous value), and return to Output Menu.

3.5.6 Testing the Output



The Test Menu causes the **Aurora H2O** to generate a 0- or 4-20mA output at the percent of scale selected. For example, in 4-20 operation, 0% = 4mA, 50% = 12mA, 100% = 20mA. This allows the proper function of recording or SCADA equipment to be verified. In 0-20 operation, 0% = 0mA, 50% = 10mA, 100% = 20mA.



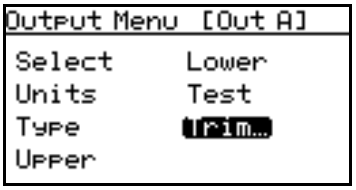
To test system output, from the Output Menu select Test and press **Enter**. The **Aurora H2O** will proceed to check the settings, and a screen similar to this display will appear.

Use the left and right arrow keys to select each digit to be changed, and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep) the previous value, and return to the Output Menu.

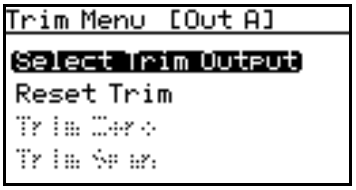
Check your output wiring. If the reading on your SCADA or DCS is off slightly, then you may use the Trim feature to trim the output zero or span.

3.5.7 Trimming the Outputs

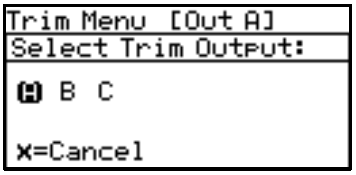
The Trim Menu enables the operator to compensate for differences in measurement of the 0/4-20 mA outputs by connected recorders or SCADA equipment. To trim the output:



Select Trim from the Output Menu and press **Enter**. The following screen appears.

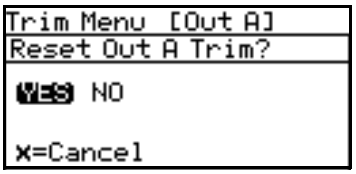


To select an output to be trimmed, highlight Select Trim Output and press **Enter**. The following screen appears

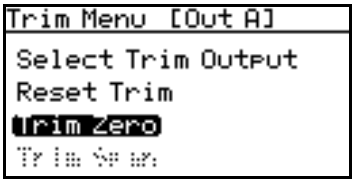


Use the left and right arrow keys to select an output (A, B or C) and press **Enter**. The screen returns to the previous display.

When performing a Trim operation, the **Aurora H2O** unit requires you to first reset the trim. To reset the trim output, highlight Reset Trim and press **Enter**. The following screen appears.



Use the left or right arrow keys to highlight YES and press **Enter**. This cancels any previous trim values, and returns the **Aurora H2O** to its factory adjustment. The display returns to the previous screen with Trim Zero highlighted.

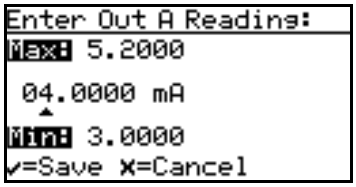


To trim the zero value, press **Enter**. A screen similar to the following appears.

This will cause the **Aurora H2O** to output 4.000 mA on the output being trimmed. The output value should then be read using the connected recorder, SCADA equipment, or DVM. Enter the value read from the connected equipment as the Zero Trim value, as follows:

3.5.7 Trimming the Outputs (cont.)

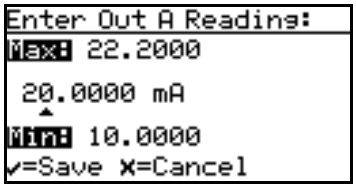
Note: *Since you cannot trim 0 mA for negative offsets, trim for the lower end of the scale is at the 4 mA output level.*



Use the left and right arrow keys to select each digit to be changed, and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep the previous value).

The Trim Menu returns with Trim Span highlighted. To change the span value, press **Enter**. A screen similar to the following appears.

This will cause the **Aurora H2O** to output 20.000 mA on the output being trimmed. The output value should then be read using the connected recorder, SCADA equipment, or DVM. Enter the value read from the connected equipment as the Span Trim value.



Use the left and right arrow keys to select each digit to be changed, and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep the previous value).

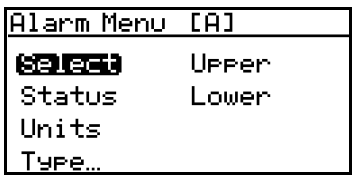
Trimming is complete. Accuracy can be verified using the Test Menu, above.

Example: Trim is reset, then Trim Zero is selected. The SCADA input reports 3.977 mA.
The operator enters “3.977” as the Zero Trim value.
Trim Span is selected. The SCADA input reports 19.985 mA.
The operator enters “19.985” as the Span Trim value.
Aurora H2O will adjust the output accordingly to true the output as read by the customer recorder, SCADA or DVM. Using the Test Menu, the operator verifies that a test value of 0% now reads 4.000 mA at the SCADA equipment, and a test value of 100% now reads 20.000 mA.

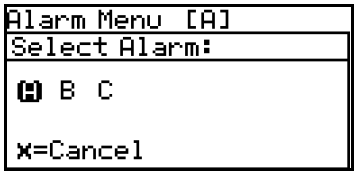
3.6 Setting Up Alarms

Note: *The* **Aurora H2O** *is* ***not*** *equipped with alarm relays. The Alarm function is useful only when reading the alarm status via Modbus.*

3.6.1 Selecting an Alarm Output

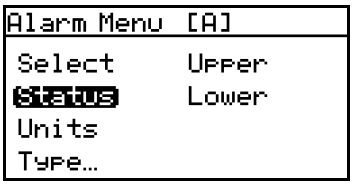


To set up alarm outputs, on the Main Menu choose Alarm and press **Enter**. From the Alarm Menu choose Select and press **Enter**. A screen similar to the following appears.

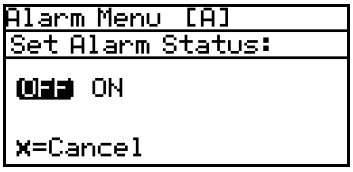


Use the arrow keys to select the output (A, B or C) to be set up and press **Enter**. The display returns to the Alarm Menu.

3.6.2 Selecting Alarm Status

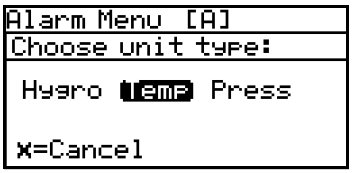


To select the alarm status, from the Alarm Menu select Status and press **Enter**. The following screen appears:

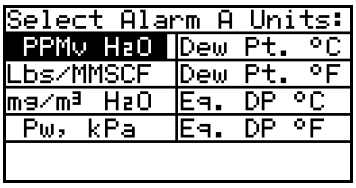


Use the arrow keys to select OFF or ON and press **Enter**. The display returns to the Alarm Menu.

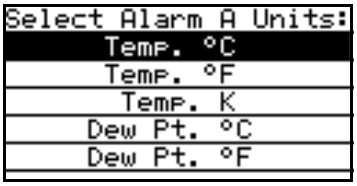
3.6.3 Selecting Alarm Units



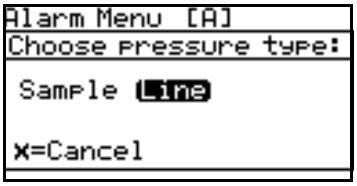
To select alarm units, from the Alarm Menu select Units and press **Enter**. Use the arrow keys to select the unit type and press **Enter**.



If Hygro was selected, this display appears. Use the arrow keys to select a unit. Press **Enter** to save (or **Cancel** to keep the previous value), and return to the Alarm Menu.

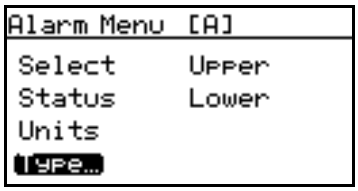


If Temperature was selected, this display appears. Use the arrow keys to select a unit. Press **Enter** to save (or **Cancel** to keep the previous value), and return to the Alarm Menu.



If Pressure was selected, this display appears. Use the arrow keys to select a unit. Press **Enter** to save (or **Cancel** to keep the previous value), and return to the Alarm Menu.

3.6.4 Selecting an Alarm Type



To change the alarm type, from the Alarm Menu select Type and press **Enter**. A screen similar to the following appears:

Use the arrow keys to select an alarm type. Press **Enter** to save (or **Cancel** to keep the previous value), and return to the Alarm Menu.

- SetPoint: Alarm activates when parameter exceeds upper limit, and deactivates when parameter is less than lower limit.
- Inner Band: Alarm activates when parameter is between upper and lower limits.
- Outer Band: Alarm activates when parameter is outside upper and lower limits.

3.6.5 How the Alarm Types Work

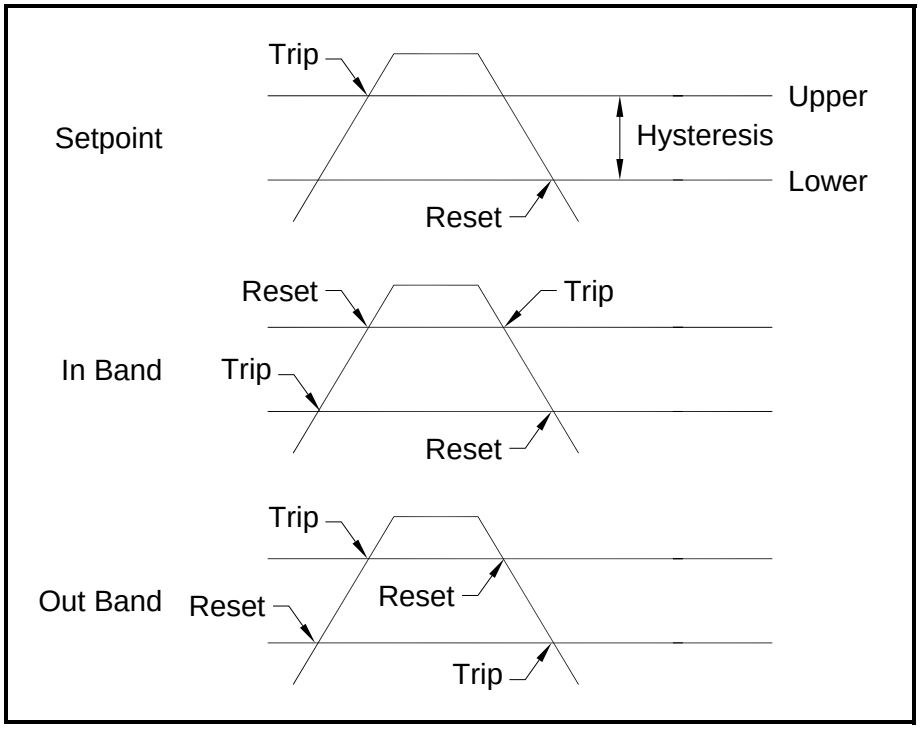
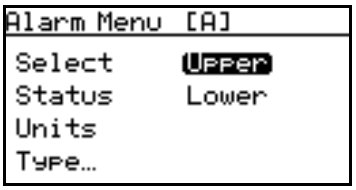
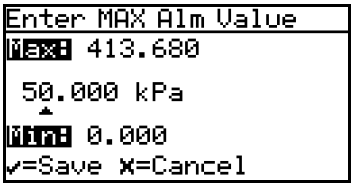


Figure 40: Example of Alarm Types

3.6.6 Changing the Upper Alarm Span

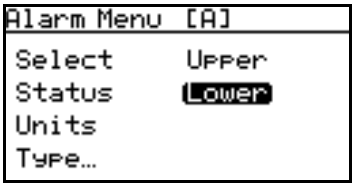


To adjust the upper alarm span, from the Alarm Menu select Upper and press **Enter**. A screen similar to the following appears.

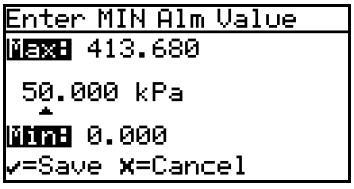


Use the left and right arrow keys to select each digit to be changed and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep the previous value), and return to Output Menu.

3.6.7 Changing the Lower Alarm Span



To adjust the lower alarm span, from the Alarm Menu select Lower and press **Enter**. A screen similar to the following appears.



Use the left and right arrow keys to select each digit to be changed and the up and down arrow keys to increase or decrease its value. Press **Enter** to save (or **Cancel** to keep the previous value), and return to Output Menu.

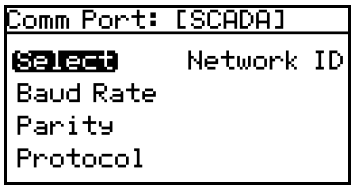
Chapter 4. Programming Advanced Features

4.1 Comm Port Settings

To access the communication port settings, from the Main Menu select Settings and press **Enter**. The following screen appears:

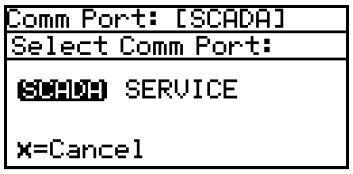
To access the communications port settings, select Comms… and press **Enter**. The following screen appears:

4.1.1 Selecting a Comm Port



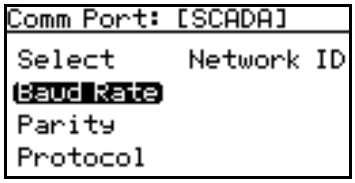
There are two physical comm ports in the **Aurora H2O**. Comm Port 1 is aligned to *SCADA* in the instrument program and Comm Port 2 is aligned to *SERVICE*. This setup enables the user to have Comm Port 1 set up for the primary digital output (for example, RS-485 to the customer SCADA system), and Comm Port 2 to be used for service (for example, to enable a service engineer to interface with the **Aurora H2O** using an RS-232 cable connected to a laptop PC in the field, running **AuroraView** software).

To select a communication port, use the arrow keys to highlight Select and press **Enter**. The following screen appears.

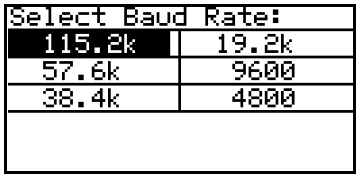


Select SCADA or SERVICE and press **Enter**. The screen returns to the Comm Port Menu.

4.1.2 Setting the Baud Rate



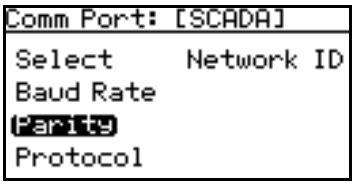
To set the baud rate, from the Comm Port Menu select Baud Rate and press **Enter**. The following screen appears.



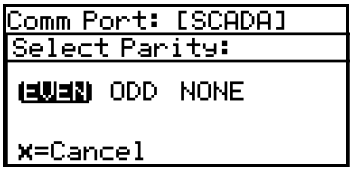
Use the arrow keys to highlight the desired baud rate and press **Enter**. The screen returns to the Comm Port Menu.

IMPORTANT: *If you are using version* **1A** *of the* **Aurora H2O** *firmware, do not select the* 1200 *or* 2400 *baud rate.*

4.1.3 Setting Parity

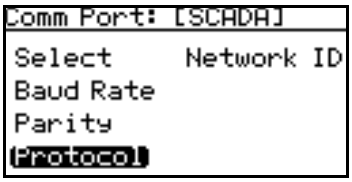


To set parity, from the Comm Port Menu select Parity and press **Enter**. The following screen appears.

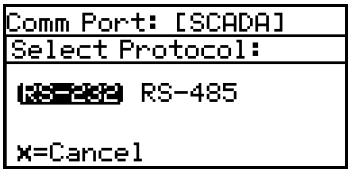


Use the arrow keys to highlight the desired parity and press Enter. The screen returns to the Comm Port Menu.

4.1.4 Selecting Protocol

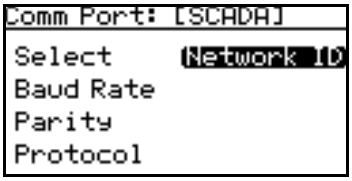


To choose the protocol, from the Comm Port Menu select Protocol and press Enter. The following screen appears.

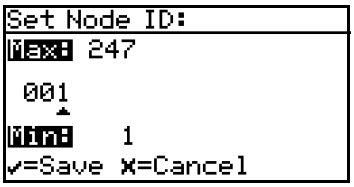


Use the arrow keys to highlight the desired protocol and press **Enter**. The screen returns to the Comm Port Menu.

4.1.5 Setting the Network ID



To set the network ID, from the Comm Port Menu select Network ID and press **Enter**. The following screen appears.

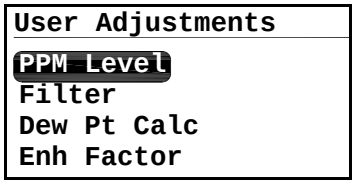


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Comm Port Menu.

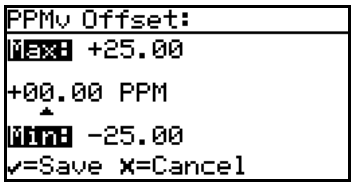
4.2 Adjust Offset Values

To adjust offset values, from the Settings Menu select Adjust… and press **Enter**. The following screen appears.

4.2.1 Adjusting the PPMv Offset

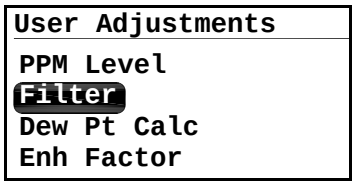


To adjust the PPMv offset, select PPM Level and press **Enter**. The following screen appears.

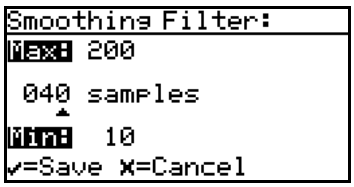


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the User Adjustments Menu.

4.2.2 Adjusting the Smoothing Filter Offset



To adjust the smoothing filter offset, from the User Adjustments Menu select Filter and press **Enter**. The following screen appears.



The smoothing filter setting is used to change the system responsiveness. It is a moving average filter to smooth the moisture readings. 1 sample = 1 scan. Generally, **Aurora H2O** can perform up to 12 samples per second. The minimum setting is 10 samples, and the maximum setting is 200 samples. The default, as set at the factory, is typically 40.

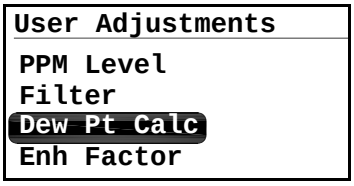
Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the User Adjustments Menu.

4.2.3 Setting the Dew Point Calculation Method

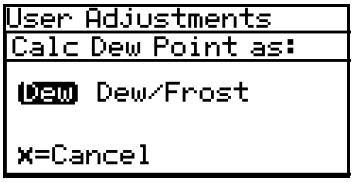
- The **dew point** is the temperature at which the air is saturated with respect to water vapor over a **liquid** surface.
- The **frost point** is the temperature at which the air is saturated with respect to water vapor over an **ice** surface.

There can be a difference of several degrees C between the dew point and the frost point.

- When set for Dew/Frost, the **Aurora H2O** will report the *Dew Point* if the reading is above freezing, and will report the *Frost Point* if the reading is below freezing.
- When set for Dew Point, the **Aurora H2O** will calculate the *Dew Point* temperature, even if that temperature is below freezing.



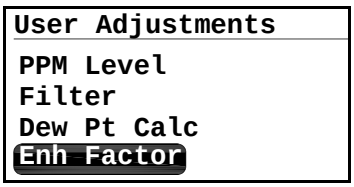
To set the dew point calculation method, from the User Adjustments Menu select Dew Pt Calc and press **Enter**. The following screen appears.



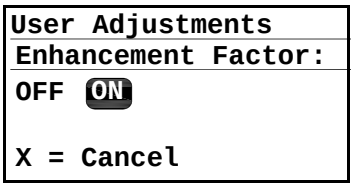
Use the arrow keys to highlight the desired dew point setting and press **Enter**. The screen returns to the User Adjustments Menu.

- The Dew calculation should be used for compatibility with ASTM-1142/IGT-8. The tables and calculations in those reports require measurements and provide results in dew point, regardless of the actual phase (dew or frost).
- The Dew/Frost calculation should be used for compatibility with ISO-18453:2004, or when using a chilled mirror apparatus as a check standard.

4.2.4 Adjusting the Enh Factor



The Enhancement (Enh) Factor is used to adjust the calculated *Pressure Dew Point* (Equivalent Dew Point) **in nitrogen** for the effects of pressure.To select whether an enhancement factor is applied to the dew point calculation, from the User Adjustments Menu select Enh Factor and press **Enter**. The following screen appears.



The Enhancement (Enh) Factor can be turned OFF or ON as required.

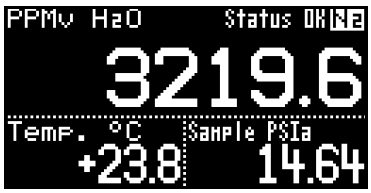
Use the left or right arrow key to select your choice and press **Enter**. The screen returns to the User Adjustments Menu.

Note: *The* Enhancement Factor *does not apply when operating in methane/natural gas, as those calculations are designed to be consistent with the methods described in ASTM D-1142.*

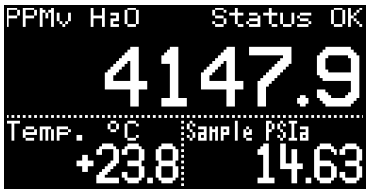
4.3 Set Up the Background Gas

4.3.1 Selecting the Type of Gas

Beginning with firmware version **H2O.001.C**,.the background gas is selectable from the Settings Menu. For normal operation in natural gas service, **Methane** should be selected as the background gas. For verification testing, it may be desirable to use **Nitrogen** with a known moisture concentration. In this application, **Nitrogen** should be selected as the background gas.



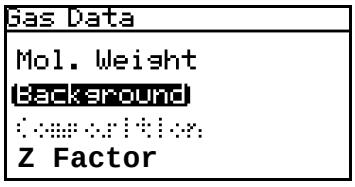
The **Aurora H2O** provides a positive indication if it is operating in Nitrogen mode. An **N2** indicator will appear in the upper right corner of the LCD, adjacent to the status message.



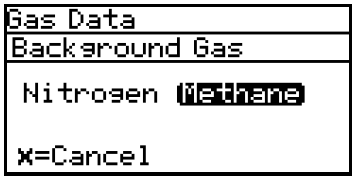
In normal Methane operation, only the status message is displayed.

Unless otherwise requested, the **Aurora H2O** is shipped from the factory configured for Methane operation.

To change the type of background gas, from the Settings Menu select Gas and press **Enter**. The following screen appears.



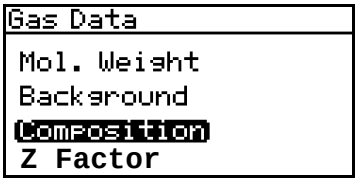
From the Gas Data menu, select Background and press **Enter**. The following screen appears.



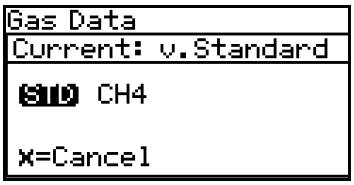
Use the arrow keys to select the desired background gas, and press **Enter**. The background gas selection is now complete. Press **Cancel** to return to the display page.

4.3.2 Setting the Gas Composition

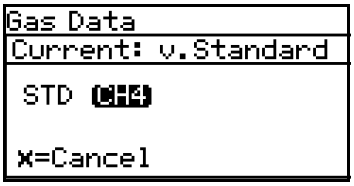
Note: *The* Gas Composition *option is available only if* Methane *is selected as the* Background Gas.



To set the gas composition, from the Gas Data Menu select Composition and press **Enter**. The following screen appears.



The first choice is STD, the composition of our standard calibration mixture (90.0% CH4, 6.0% N2 and 4.0% CO2. To set the standard mixture, select STD and press **Enter**. The screen returns to the previous menu.



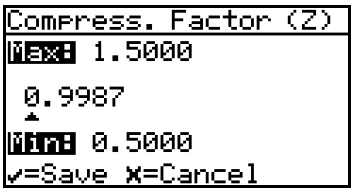
The second choice is CH4, a composition of 100.0% Methane (CH4), for use when using bottled gas for verification. To set the Methane composition, select CH4 and press **Enter**. The screen returns to the previous menu.

Note: *An additional choice or two will be available above only if the customer has requested optional custom gas compositions.*

4.3.3 Setting the Z Factor

The **Z factor** is a number that accounts for the non-ideal compressibility of natural gas, and is vital for accurate calculation of mass/volume (lbs/MMSCF, mg/m^3).

To set the **Z factor**, from the Gas Data Menu, select Z Factor and press enter. The following screen appears.



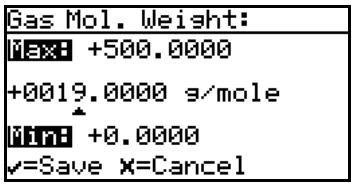
Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Settings Menu.

4.3.4 Adjusting the Gas Offset

The input information for gas molecular weight is not currently used for any moisture calculations and is reserved for future use.

- lbs/MMSCF is calculated using IGT Research Bulletin #8 and ASTM D-1142-95 referenced at 60°F, 1 ATM.
- mg/cm^3 is based on ideal gas law derivation referenced at 15°C, 1.01325 kPa.

To adjust the gas molecular weight offset, from the Settings Menu select Gas and press **Enter**. From the Gas Data menu select Mol. Weight and press **Enter**. The following screen appears.



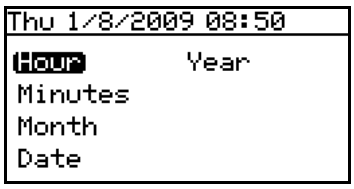
Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Settings Menu.

4.4 Clock Settings

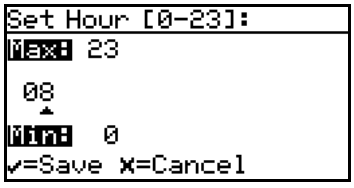
The clock settings are for informational purposes. They are used to keep track of the test analyzer start time and the laser operational time.

To reset the clock, from the Settings Menu select Clock and press **Enter**. The following screen appears.

4.4.1 Resetting the Hour

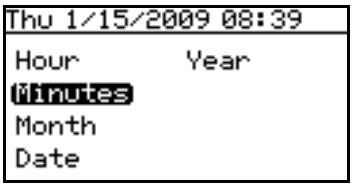


To reset the hour, from the Clock Menu select Hour and press **Enter**. The following screen appears.

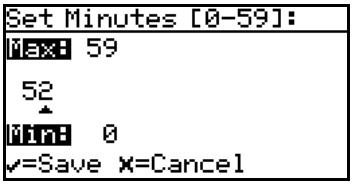


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Clock Menu.

4.4.2 Resetting the Minutes

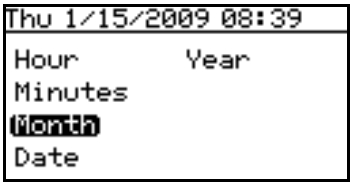


To reset the minutes, from the Clock Menu select Minutes and press **Enter**. The following screen appears.

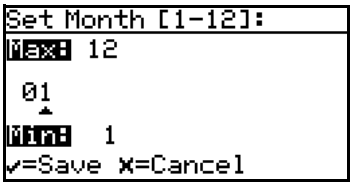


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Clock Menu.

4.4.3 Resetting the Month

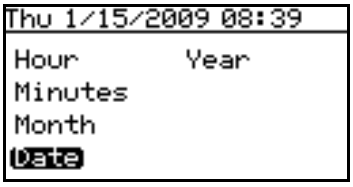


To reset the month, from the Clock Menu select Month and press **Enter**. The following screen appears.

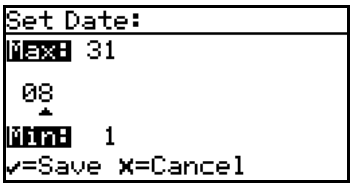


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Clock Menu.

4.4.4 Resetting the Date

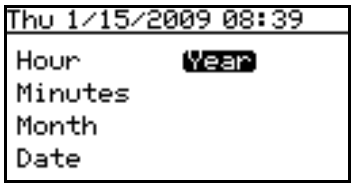


To reset the date, from the Clock Menu select Date and press **Enter**. The following screen appears.

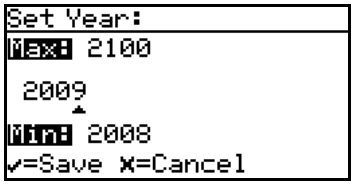


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Clock Menu.

4.4.5 Resetting the Year



To reset the year, from the Clock Menu select Year and press **Enter**. The following screen appears.

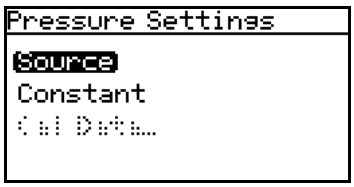


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Clock Menu.

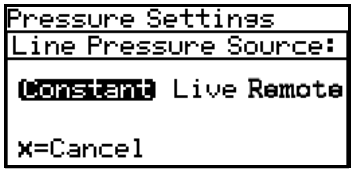
4.5 Pressure Settings

To reset the pressure settings, from the Settings Menu, select Pressure… and press **Enter**. The following screen appears.

4.5.1 Setting the Source

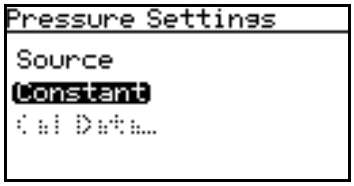


To reset the source, from the Pressure Menu, select Source and press **Enter**. The following screen appears.

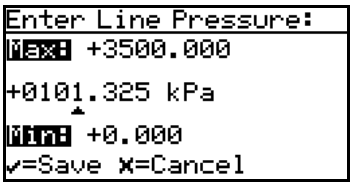


Use the left and right arrow keys to select the line pressure source. Live accepts a pressure value from a pressure transmitter and Remote accepts a value via a Modbus connection. To set a constant value, select Constant and press **Enter**. The screen returns to the Pressure Menu.

4.5.2 Changing the Constant



If the pressure source selected is Constant, to reset its value, select Constant from the Pressure Menu and press **Enter**. The following screen appears.

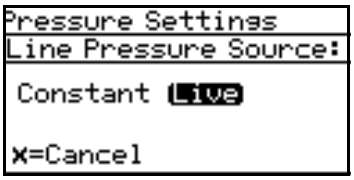


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Pressure Menu.

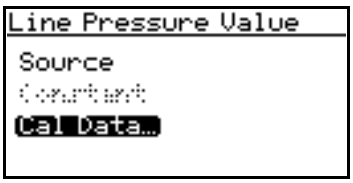
Note: *Data entry for this setting is only in kPa.*

4.5.3 Editing Pressure Calibration

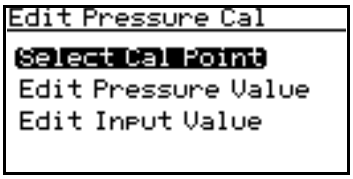
Pressure input in this section is used only for equivalent dew point calculations. Equivalent dew point is the dew point of the process gas at the process pressure. Input a "constant" value if the line pressure is at a normal pressure, or use an external pressure transmitter to input a "live" pressure input into the **Aurora H2O** analyzer.



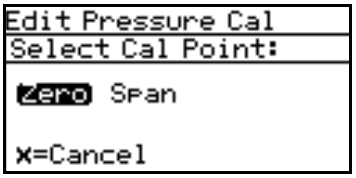
To edit the pressure calibration, from the Line Pressure Source Menu, select Live and press **Enter**. The following screen appears.



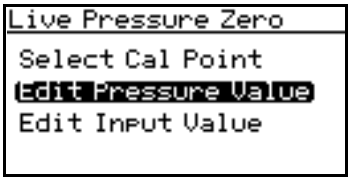
To edit the Calibration Data, use the arrow keys to select Cal Data and press **Enter**. The following screen appears.



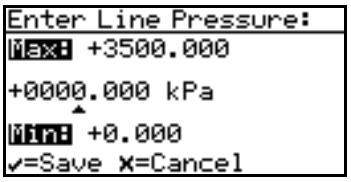
To select the Calibration Point, use the up and down arrow keys to highlight Select Cal Point and press **Enter**. The following screen appears.



Use the left and right arrow keys to select Zero or Span and press **Enter**. The screen returns to the previous menu.

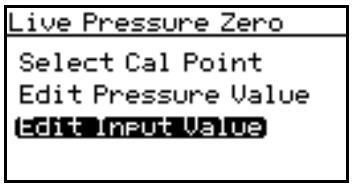


To edit the Pressure Value, use the up and down arrow keys to select Edit Pressure Value and press **Enter**. The following screen appears.

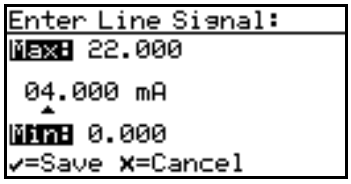


Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the previous menu.

4.5.3 Editing Pressure Calibration (cont.)



To edit the Input Value, use the up and down arrow keys to select Edit Input Value and press **Enter**. The following screen appears.



Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the previous menu.

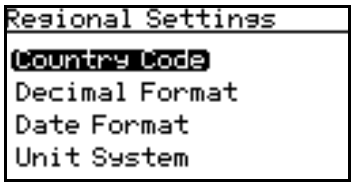
4.6 Regional Settings

This section enables the setting of regional information, depending on the location of the **Aurora H2O**.

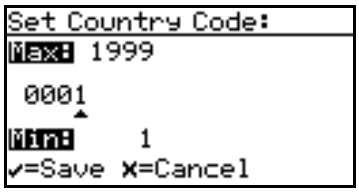
To reset the regional settings, from the Settings Menu, select Locale… and press **Enter**. The following screen appears.

Note: *Locale settings for your order have been set at the factory and are access code protected. If you determine a need to access* Regional Settings*, contact the factory for assistance.*

4.6.1 Setting the Country Code



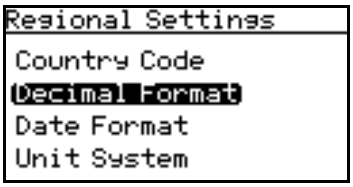
To edit the country code, from the Regional Settings Menu select Country Code and press **Enter**. The following screen appears. A passcode is required to make changes.



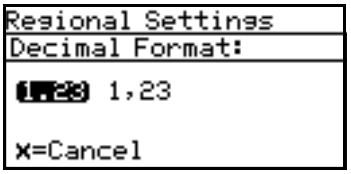
Use the left and right arrow keys to select each digit to be changed. Use the up and down arrow keys to change the value. When finished, press **Enter**. The screen returns to the Regional Settings Menu.

- Country Codes = international telephone country codes.
- Default = 1 for U.S.
- Option = 81 for Japan is available to conform to METI requirements.

4.6.2 Setting the Decimal Format

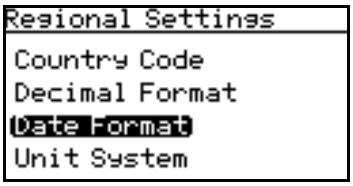


The Decimal Format option determines whether a decimal [**.**] or a comma [**,**] is used as the decimal separator. To edit the decimal format, from the Regional Settings Menu select Decimal Format and press **Enter**. The following screen appears.

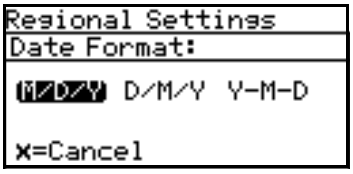


Use the left and right arrow keys to select a decimal [**.**] or a comma [**,**] as the decimal separator and press **Enter**. The screen returns to the Display Menu.

4.6.3 Setting the Date Format



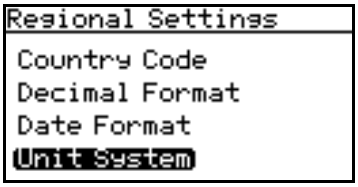
To edit the date format, from the Regional Settings Menu select Date Format and press **Enter**. The following screen appears.



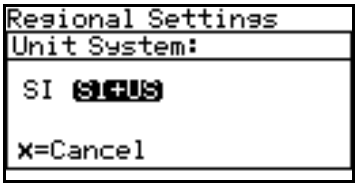
Use the left and right arrow keys to select the desired date format and press **Enter**. The screen returns to the previous display.

4.6.4 Setting the Unit System

IMPORTANT: *If the* Country Code *(see* "Setting the Country Code" on page 59*) has been set to* 81 (Japan) *the* Unit System *menu is not available.*



To select the unit system to be used for measurements, select Unit System and press **Enter**. The following screen appears.



Use the left and right arrow keys to select the Unit System desired [SI = only metric units are available in the selection menus; SI + US = both metric and English units are available in the selection menus] and press **Enter**. The screen returns to the Regional Settings Menu.

Note: *Changing the* Unit System *setting from* SI+US *to* SI *in the above menu will* **NOT** *immediately change the current* Display *or* Outputs *units. This is because it is not possible for the* **Aurora H2O** *to know the* SI *measurement units desired by the operator to replace any currently displayed or output English units. However, the next time the operator selects different* Display *(see* "Selecting Primary Units" on page 39*) or* Outputs *(see* "Selecting Output Units" on page 42*) units, only* SI *units will be available in the menu.*

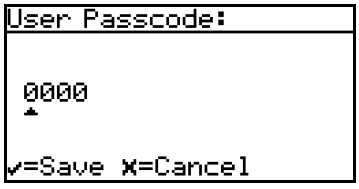
4.7 User Calibration

Beginning with software revision H2O.001.F, the **Aurora H2O** supports a two-point User Calibration for use in methane/natural gas. This is provided so that a field calibration can be easily performed to cause the **Aurora H2O** measurement to correspond to a calibration gas or other moisture device. The User Calibration is independent from, and does not affect, the Factory Calibration. The **Aurora H2O** can be quickly switched between User and Factory calibration at any time.

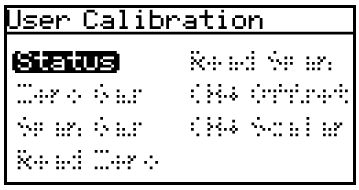
Before the calibration can be performed, the **Aurora H2O** must be operating correctly in methane or natural gas, with methane selected as the Background Gas.

Choose Settings… from the Main Menu. A User Cal… selection is now provided.

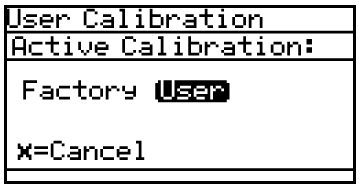
Note: *If the* **Aurora H2O** *is set for Nitrogen as the background gas, the* User Cal *selection will be disabled/grayed out.*



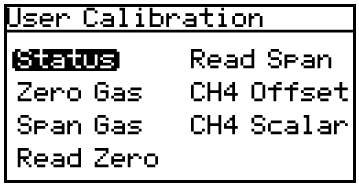
The **Aurora H2O** will prompt for the User Passcode [2719]



By default, the **Aurora H2O** is operating with the Factory calibration, so the User Calibration Menu is disabled with the exception of the Status selection.



Select Status, and choose User as the Active Calibration.

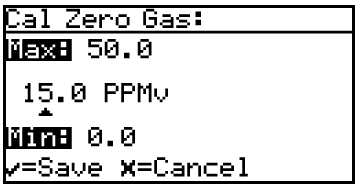


The User Calibration Menu is now enabled.

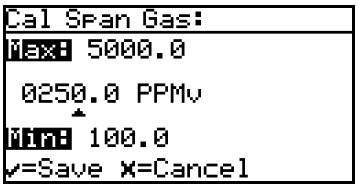
4.7 User Calibration (cont.)

The selections on the User Calibration Menu include these functions:

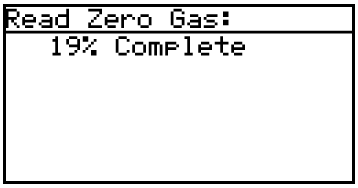
Item	Purpose
Zero Gas	User specifies the water concentration, in PPMv, of the “Zero”, or dry gas.
Span Gas	User specifies the water concentration, in PPMv, of the “Span”, or Cal/Wet gas.
Read Zero	The **Aurora H2O** will read the signal while exposed to the Zero gas.
Read Span	The **Aurora H2O** will read the signal while exposed to the Span gas, then determine the CH4 Offset and Scalar calibration values.
CH4 Offset	Permits the user to view/edit the calculated offset term.
CH4 Scalar	Permits the user to view/edit the calculated scalar (gain) term.



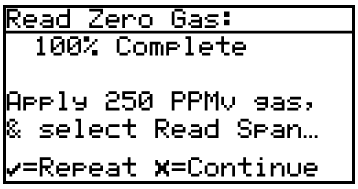
First select the Zero Gas and Span Gas items, to specify the cal gases to be used. The zero gas must be in the range of 0.0 to 50.0 PPMv water. It is recommended that the zero gas be 10.0 PPMv or higher for best results. The Span gas must be in the range of 0.0 to 5000.0 PPMv water. It is recommended that the Span gas be 500.0 PPMv or lower for best performance.



Apply the Zero gas, and wait for the **Aurora H2O** reading to stabilize.



Note:*The user can exit to the display and return to the* User Cal Menu *without affecting the Calibration procedure.*

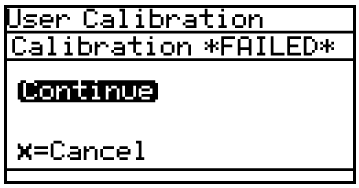


When the reading is stable, select **Read Zero**. The **Aurora H2O** performs multiple measurements for approximately 15 seconds, indicating its progress. When the readings are complete, you will be prompted to apply the span gas, and continue. If there is doubt about the stability of the zero gas, the reading can be repeated at this point.

4.7 User Calibration (cont.)

Apply the Span gas, and wait for the **Aurora H2O** reading to stabilize.

When the reading is stable, select Read Span. The **Aurora H2O** uses the current measurement, and immediately calculates the new calibration. If the calculated values are determined to be valid, the **Aurora H2O** will display "Calibration OK" and prompt you to Save the results, or Cancel. If the values are not valid, the Aurora will display "Calibration *FAILED*", and prompt you to continue. On a cal failure or Cancel, no change is made to the User Calibration values.



The CH4 Offset and CH4 Scalar items can be used to view or modify the calculated calibration points, if desired.

Note: *The default values for the CH4 Offset is 0.0 and the CH4 Scalar is 1.0. These defaults are NOT the same as the Factory Calibration! Making the User Cal active without performing the actual calibration will adversely affect the accuracy of the* **Aurora H2O**. *If there is any doubt about the quality/accuracy of the gases used, the* **Aurora H2O** *should be returned to the Factory calibration using the Status item.*

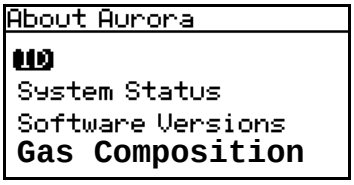
4.8 Service Settings

CAUTION! **The *Service Settings Menu* should be used by factory-trained personnel only!**

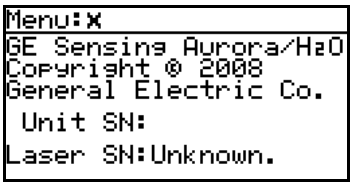
4.9 Aurora H2O Information

To check the **Aurora H2O** information, from the Main Menu select About and press **Enter**. The following screen appears.

4.9.1 Checking the ID

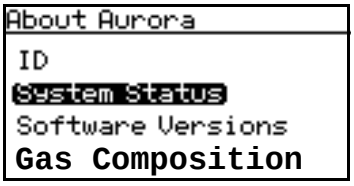


To check identification information, select ID and press **Enter**. A screen similar to the following appears.

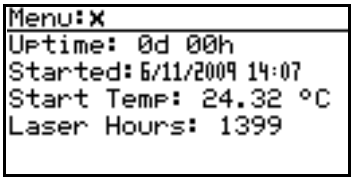


To return to the About Menu, press **Enter**.

4.9.2 Checking the System Status



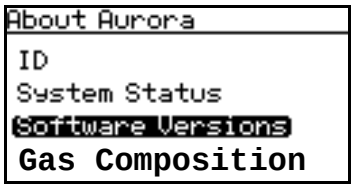
To view the status of the **Aurora H2O** system, from the About Menu select System Status and press **Enter**. A screen similar to the following appears.



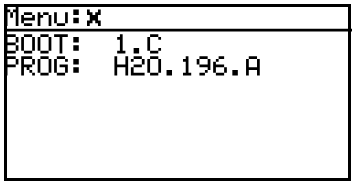
Uptime: is the elapsed time since the **Aurora H2O** was powered on or reset.
Started: is the date and time that the **Aurora H2O** was last powered on/reset.
Start Temp: is the laser housing temperature as measured at the last startup/reset.
Laser Hours: indicates the total lifetime that the laser has been energized.

To return to the About Menu, press **Enter**.

4.9.3 Checking the Software

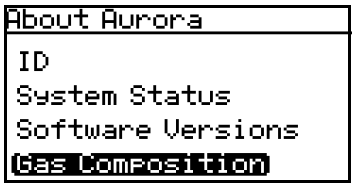


To view the software versions being used, from the About Menu select Software Versions and press **Enter**. A screen similar to the following appears.

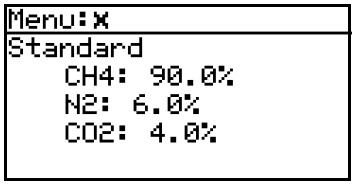


To return to the About Menu, press **Enter**.

4.9.4 Checking the Gas Composition



To view the gas content, from the About Menu select Gas Composition and press **Enter**. A screen similar to the following appears.



To return to the About Menu, press **Enter**.

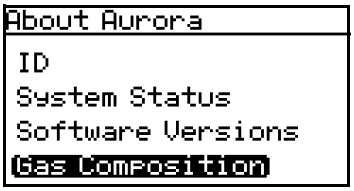
4.9.5 Checking the Alternate Gas Composition

The **Aurora H2O** TDLAS is normally calibrated to a standard gas mixture that is representative of "typical" natural gas. The primary components and concentrations of this gas mixture are:

Component	Concentration
Methane (CH4)	90.0%
Nitrogen (N_2)	6.0%
Carbon Dioxide (CO_2)	4.0%

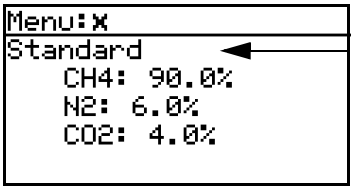
For special applications, where the composition of the gas to be measured differs significantly from the standard, GE can provide an alternate calibration. If this service has been ordered, the **Aurora H2O** will be shipped from the factory with both the standard and a custom calibration installed.

The calibration in use can be verified at any time using the **Aurora H2O** About… menu. From the Main Menu, select About and press **Enter**. The following screen appears.



From the About Aurora menu, select Gas Composition and press **Enter**. The following screen appears.

An identifier label for the gas composition will be displayed above the components:

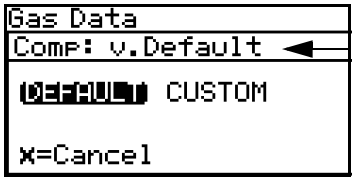


Gas Composition Identifier

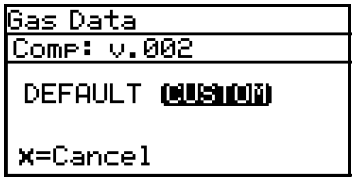
4.10 Custom Gas Composition

If a custom Gas Composition has been installed, an additional Composition menu selection will appear in the Settings/Gas Data menu.

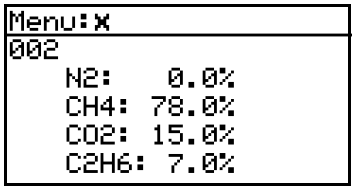
Note: *If no alternate composition is available, the menu selection will be disabled and "grayed out".*



Gas Composition Identifier



The new composition can be verified by selecting About… Gas Composition:

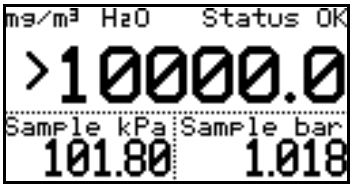


Note: *Unless otherwise requested, the* **Aurora H2O** *is shipped from the factory configured to use the custom gas composition.*

4.11 Locking/Unlocking the Display

To lock the **Aurora H2O** against any future changes, from the Main Menu select Lock and press **Enter**. The screen returns to the standard display.

Note: *This menu option is the same as exiting the programming menu and waiting for a keypad time-out to lock the keypad.*



To unlock the **Aurora H2O** for changes, press **Cancel**, **Enter**, **Cancel** as instructed in *Unlocking the Keypad* on *page 37*.

Chapter 5. AuroraView Interface Software

5.1 Capabilities

Your **Aurora H2O** Analyzer is shipped with a CD which includes a PC-Software Application called **AuroraView**. With **AuroraView**, you can:

- View **Aurora H2O** Configuration Items such as Alarms & Outputs.
- Use the DataLog function to copy data to a comma delimited .txt file which can be opened by spreadsheet applications such as Microsoft Excel.
- Plot real-time data for one or more **Aurora H2O** parameters
- Manipulate plotted data in a variety of ways such as: color, line type, zoom in/out, etc.
- Trend tabular data in real-time.
- Show Scan Plots of the moisture absorption spectra.
- Copy plots from **AuroraView** to other Window applications like Microsoft Powerpoint or Word.

AuroraView does not provide functionality for the following:

- **Aurora H2O** software updates.
- Save the **Aurora H2O** Configuration. The **Aurora H2O** has a robust design which allows the meter to recover from fault conditions without the need to upload the configuration of the meter using external software.

5.2 Requirements

AuroraView leverages a *National Instruments Run-Time* environment. This environment is supported on the following operating systems with the minimum installation requirements indicated:

- 260 MB of available hard disk space
- 64 MB of RAM or more
- 300 MHz Pentium CPU
- Windows NT 4.0 SP6 or higher, Windows ME, Windows 2000, Windows XP
- Internet Explorer v5.0 or higher

AuroraView supports the following serial interfaces:

- RS232
- RS485 Modbus

5.3 Installing AuroraView

1. Insert the *Installation CD* into the optical drive on your PC.
2. The installation program should launch automatically. If it does not, select Start → Run → Browse.

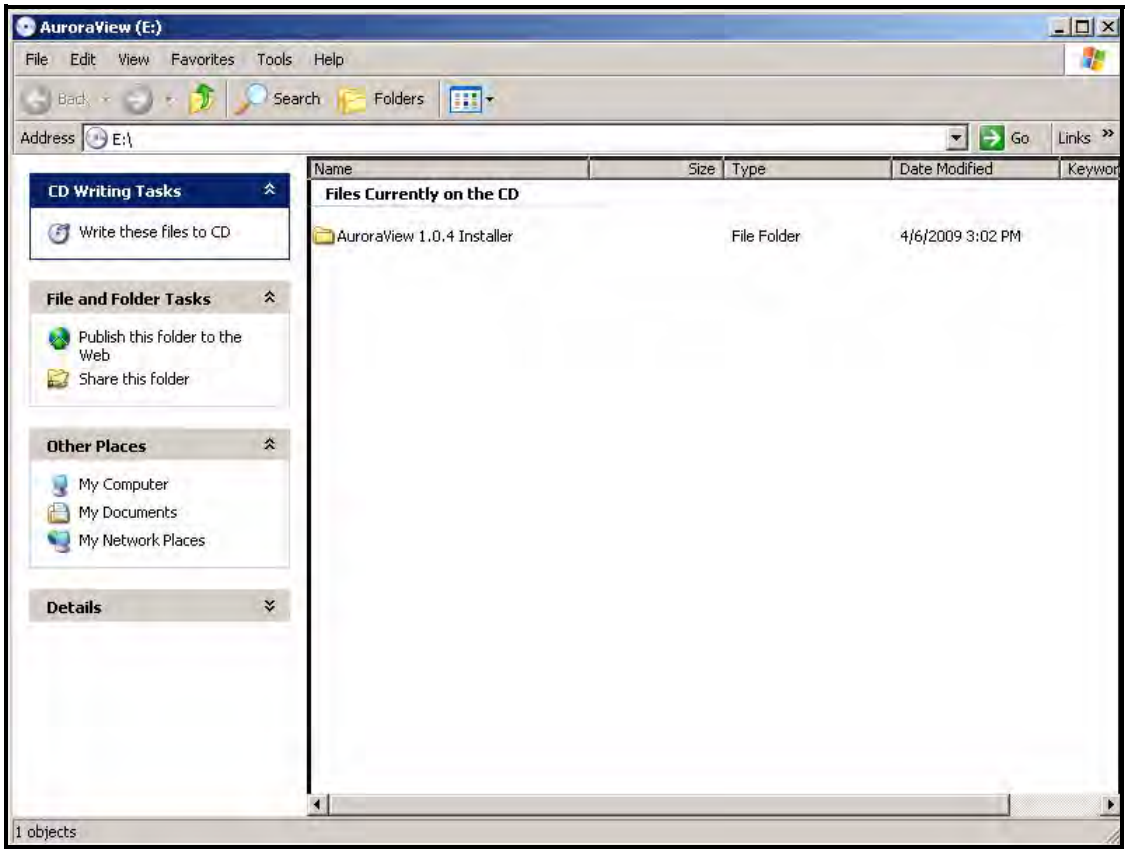


Figure 41: Initial Screen

5.3 Installing AuroraView (cont.)

3. Browse to the file named *"setup.exe"* in the root directory of the CD. Double-click the file to start the installation.

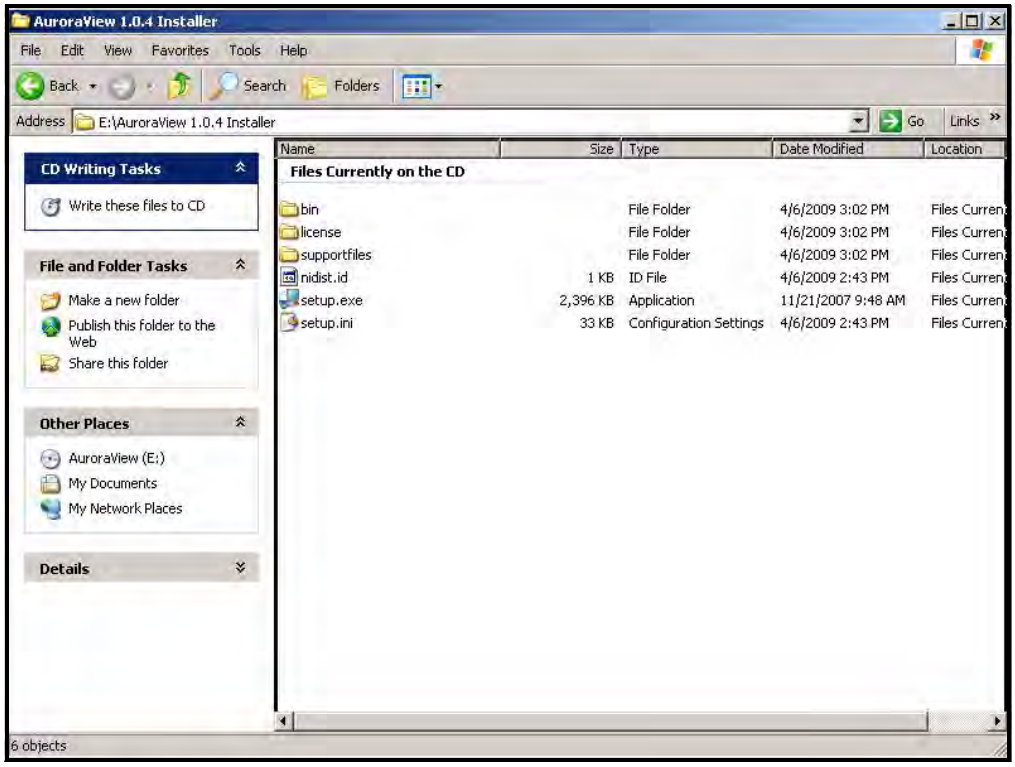

AuroraView 1.0.4 Installer
File Edit View Favorites Tools Help
Back Search Folders
Address E:\AuroraView 1.0.4 Installer
Go Links
CD Writing Tasks
Write these files to CD
File and Folder Tasks
Make a new folder
Publish this folder to the Web
Share this folder
Other Places
AuroraView (E:)
My Documents
My Network Places
Details
Name Size Type Date Modified Location
Files Currently on the CD
bin File Folder 4/6/2009 3:02 PM Files Curren
license File Folder 4/6/2009 3:02 PM Files Curren
supportfiles File Folder 4/6/2009 3:02 PM Files Curren
nidist.id 1 KB ID File 4/6/2009 2:43 PM Files Curren
setup.exe 2,396 KB Application 11/21/2007 9:48 AM Files Curren
setup.ini 33 KB Configuration Settings 4/6/2009 2:43 PM Files Curren
6 objects

Figure 42: AuroraView Installer

5.3 Installing AuroraView (cont.)

4. Exit all other programs before running the installer.

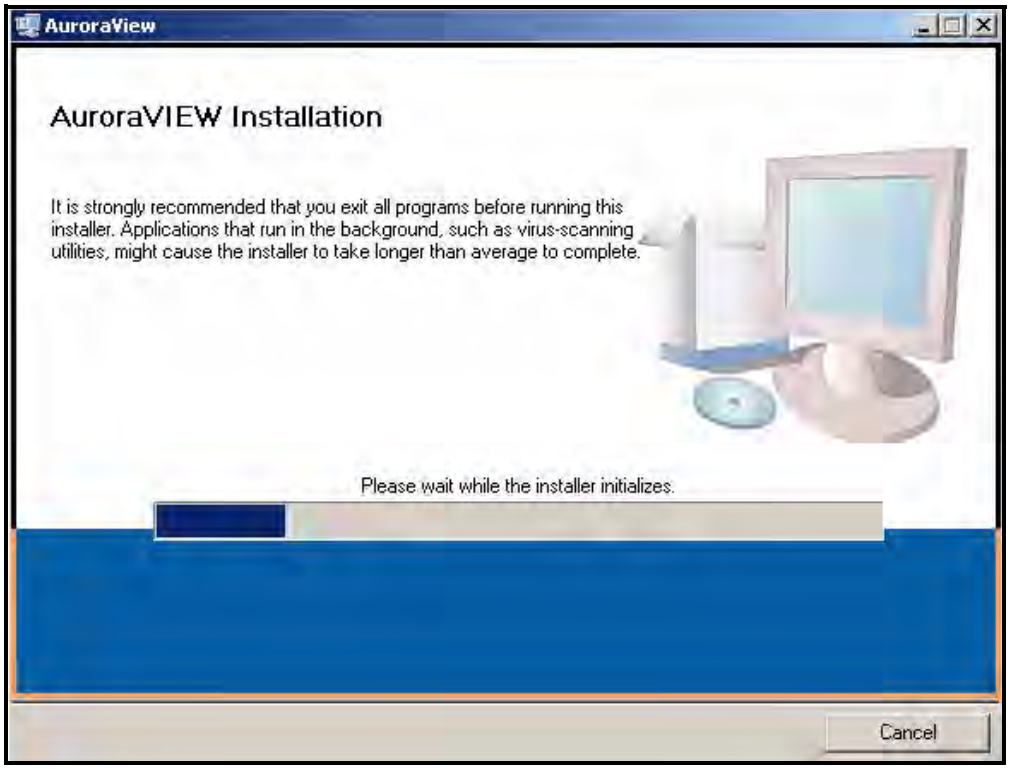

AuroraView
AuroraVIEW Installation
It is strongly recommended that you exit all programs before running this installer. Applications that run in the background, such as virus-scanning utilities, might cause the installer to take longer than average to complete.
Please wait while the installer initializes.
Cancel

Figure 43: Installation Recommendation

5.3 Installing AuroraView (cont.)

5. The next screen provides the opportunity to change installation locations if desired. When ready, click Next.

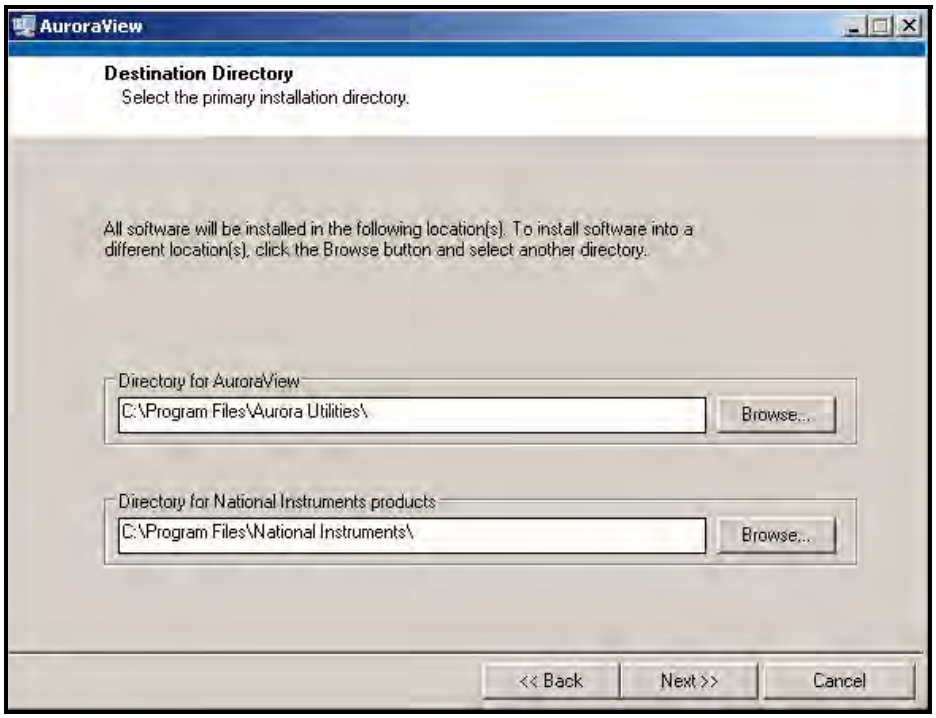

AuroraView
Destination Directory
Select the primary installation directory.
All software will be installed in the following location(s). To install software into a different location(s), click the Browse button and select another directory.
Directory for AuroraView
C:\Program Files\Aurora Utilities\
Browse...
Directory for National Instruments products
C:\Program Files\National Instruments\
Browse...
<< Back
Next >>
Cancel

Figure 44: Destination Directory

6. The next screen shows the *Software License Agreement*. Select *"I accept the License Agreement"* and click Next.

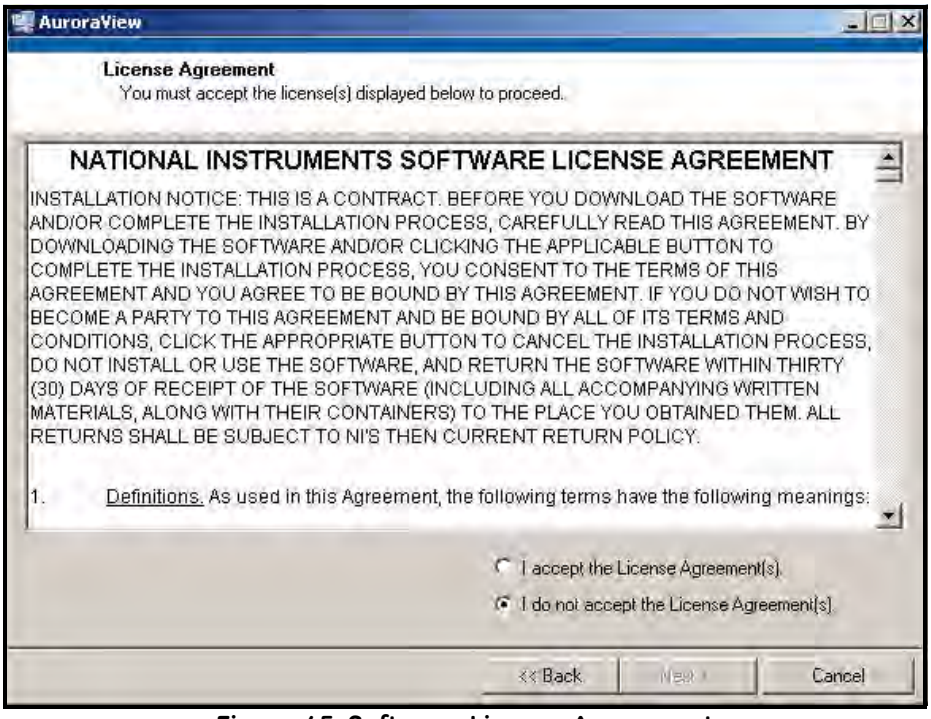

AuroraView
License Agreement
You must accept the license(s) displayed below to proceed.
NATIONAL INSTRUMENTS SOFTWARE LICENSE AGREEMENT
INSTALLATION NOTICE: THIS IS A CONTRACT. BEFORE YOU DOWNLOAD THE SOFTWARE AND/OR COMPLETE THE INSTALLATION PROCESS, CAREFULLY READ THIS AGREEMENT. BY DOWNLOADING THE SOFTWARE AND/OR CLICKING THE APPLICABLE BUTTON TO COMPLETE THE INSTALLATION PROCESS, YOU CONSENT TO THE TERMS OF THIS AGREEMENT AND YOU AGREE TO BE BOUND BY THIS AGREEMENT. IF YOU DO NOT WISH TO BECOME A PARTY TO THIS AGREEMENT AND BE BOUND BY ALL OF ITS TERMS AND CONDITIONS, CLICK THE APPROPRIATE BUTTON TO CANCEL THE INSTALLATION PROCESS, DO NOT INSTALL OR USE THE SOFTWARE, AND RETURN THE SOFTWARE WITHIN THIRTY (30) DAYS OF RECEIPT OF THE SOFTWARE (INCLUDING ALL ACCOMPANYING WRITTEN MATERIALS, ALONG WITH THEIR CONTAINERS) TO THE PLACE YOU OBTAINED THEM. ALL RETURNS SHALL BE SUBJECT TO NI'S THEN CURRENT RETURN POLICY.
1. Definitions. As used in this Agreement, the following terms have the following meanings:
I accept the License Agreement(s).
I do not accept the License Agreement(s).
<< Back
Next >
Cancel

Figure 45: Software License Agreement

5.3 Installing AuroraView (cont.)

7. The next screen provides instructions for initiating the installation. When ready, click Next to begin.

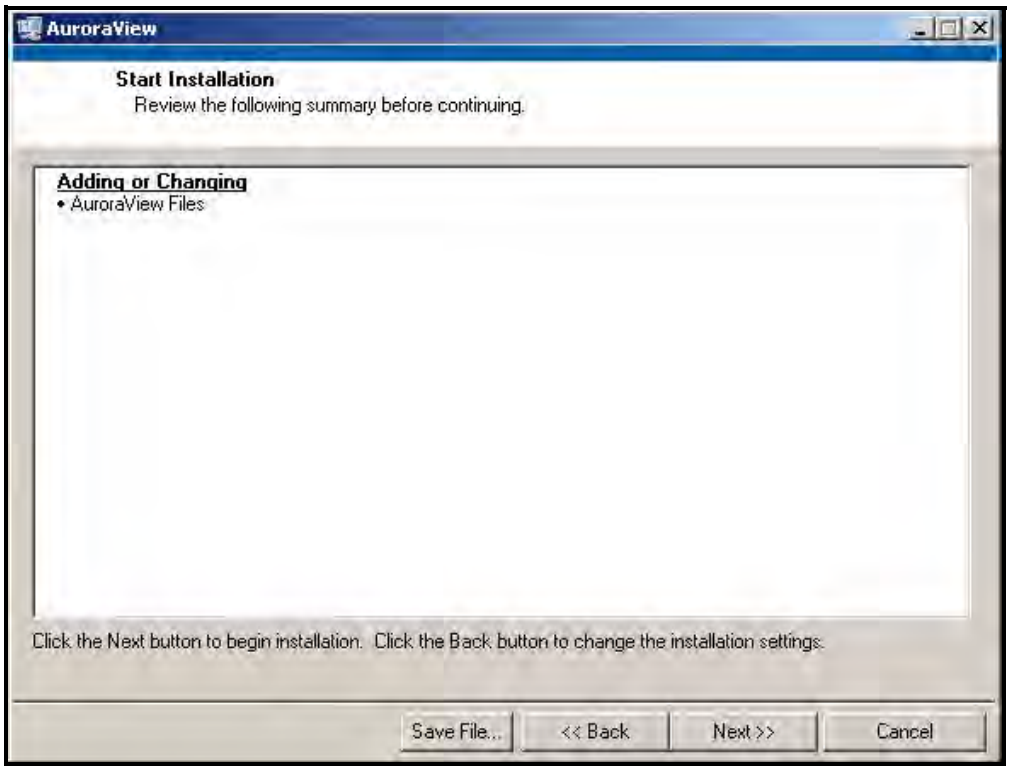


Figure 46: Starting the Installation

5.3 Installing AuroraView (cont.)

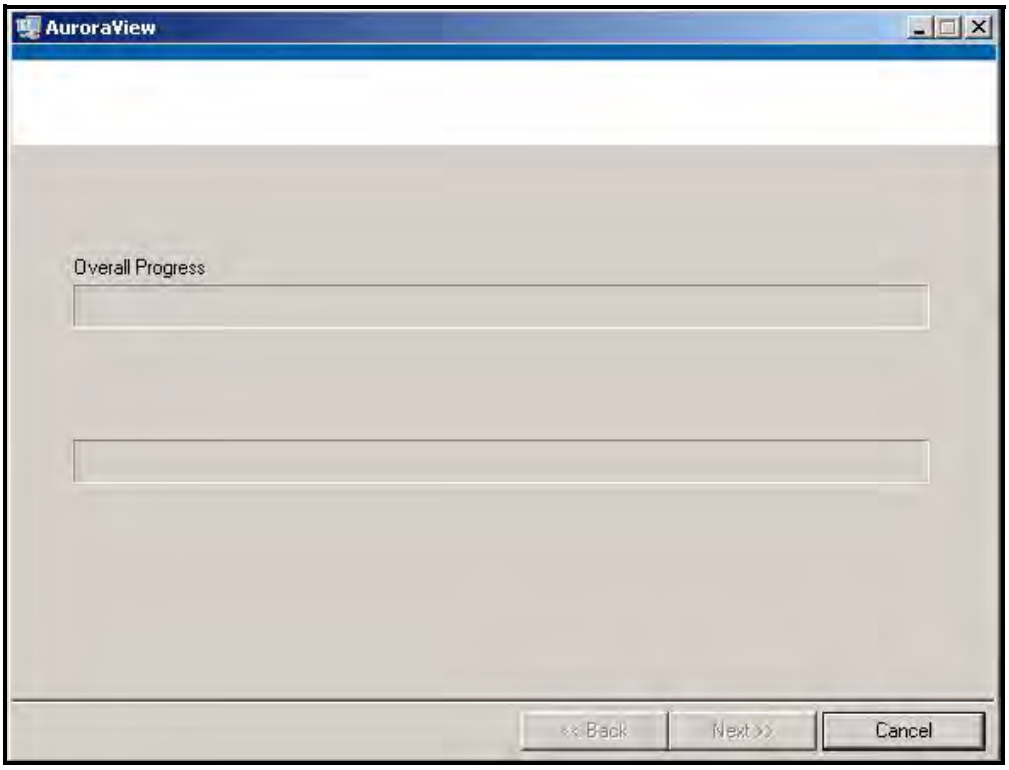


Figure 47: Overall Progress

5.3 Installing AuroraView (cont.)

8. The following screen appears when the installation is complete.

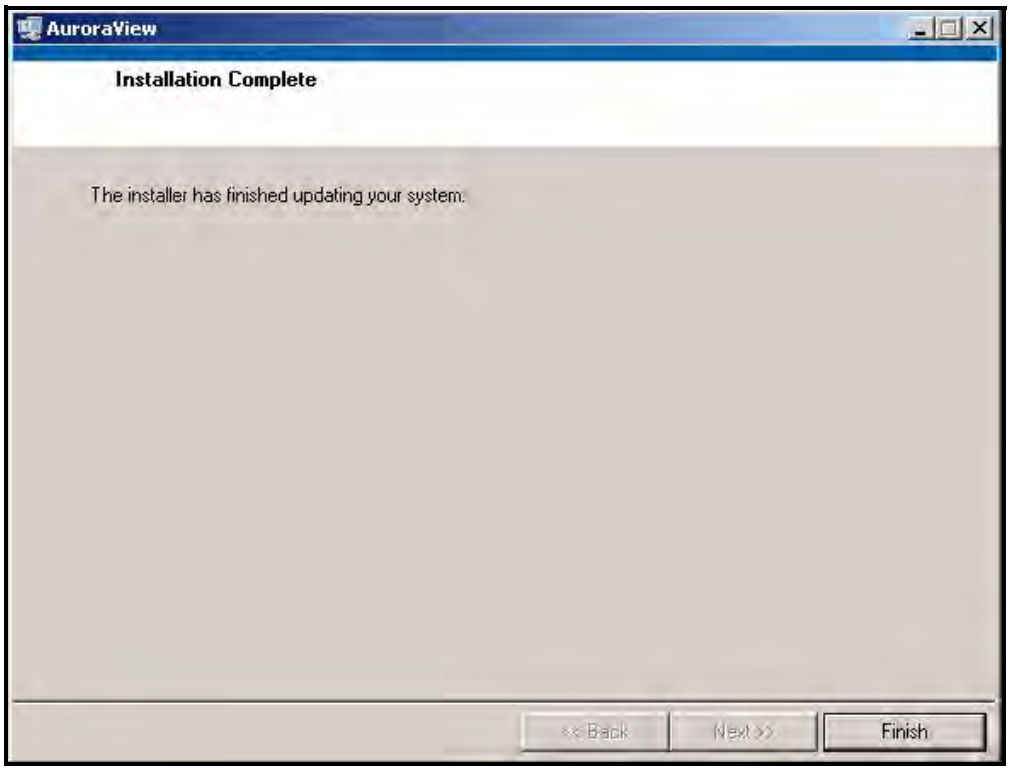


Figure 48: Installation Is Complete

5.4 Starting AuroraView

1. From the Start menu, click Programs → AuroraView → AuroraView.

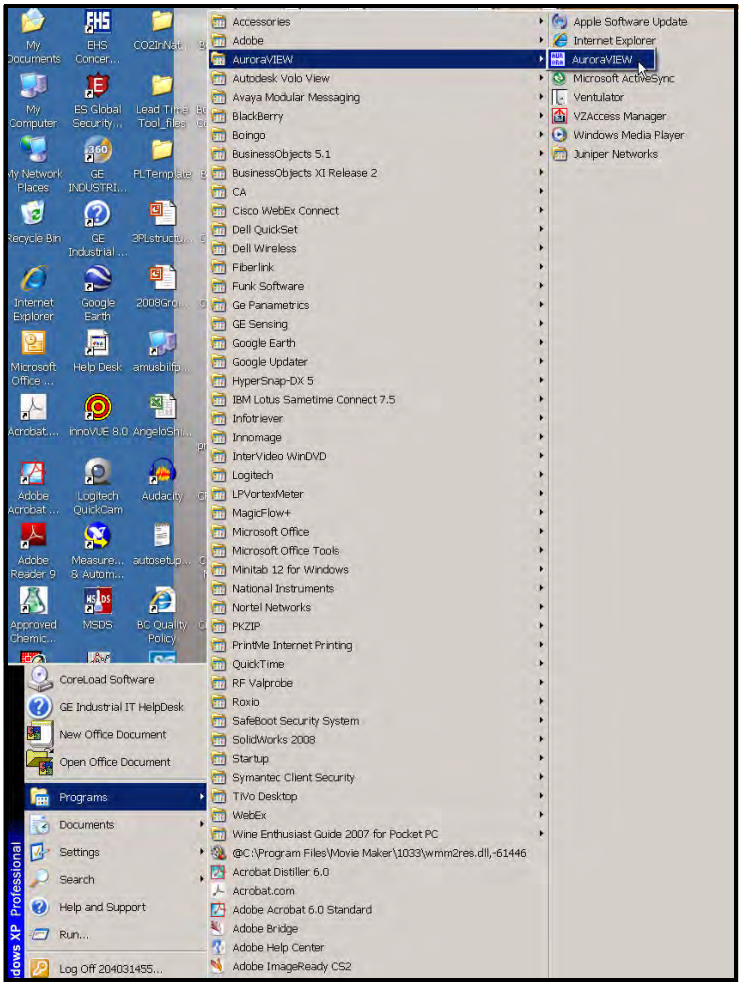


Figure 49: *AuroraView* in Programs Menu

5.4 Starting AuroraView (cont.)

2. **AuroraView** boots up and displays a screen similar to *Figure 50* below.

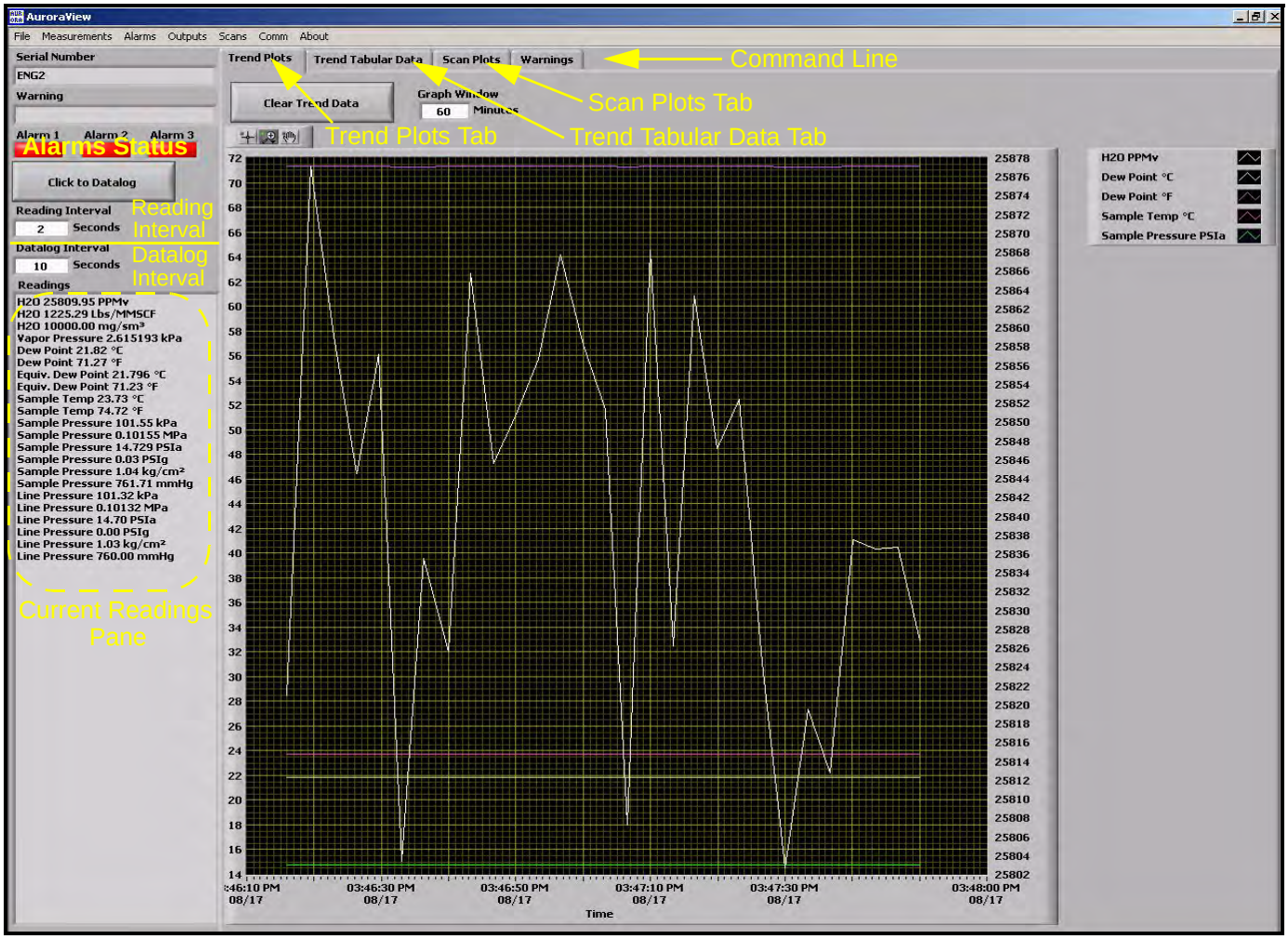


Figure 50: *AuroraView* Main Screen

5.5 Using the Main Menus

1. Click Measurements → Config

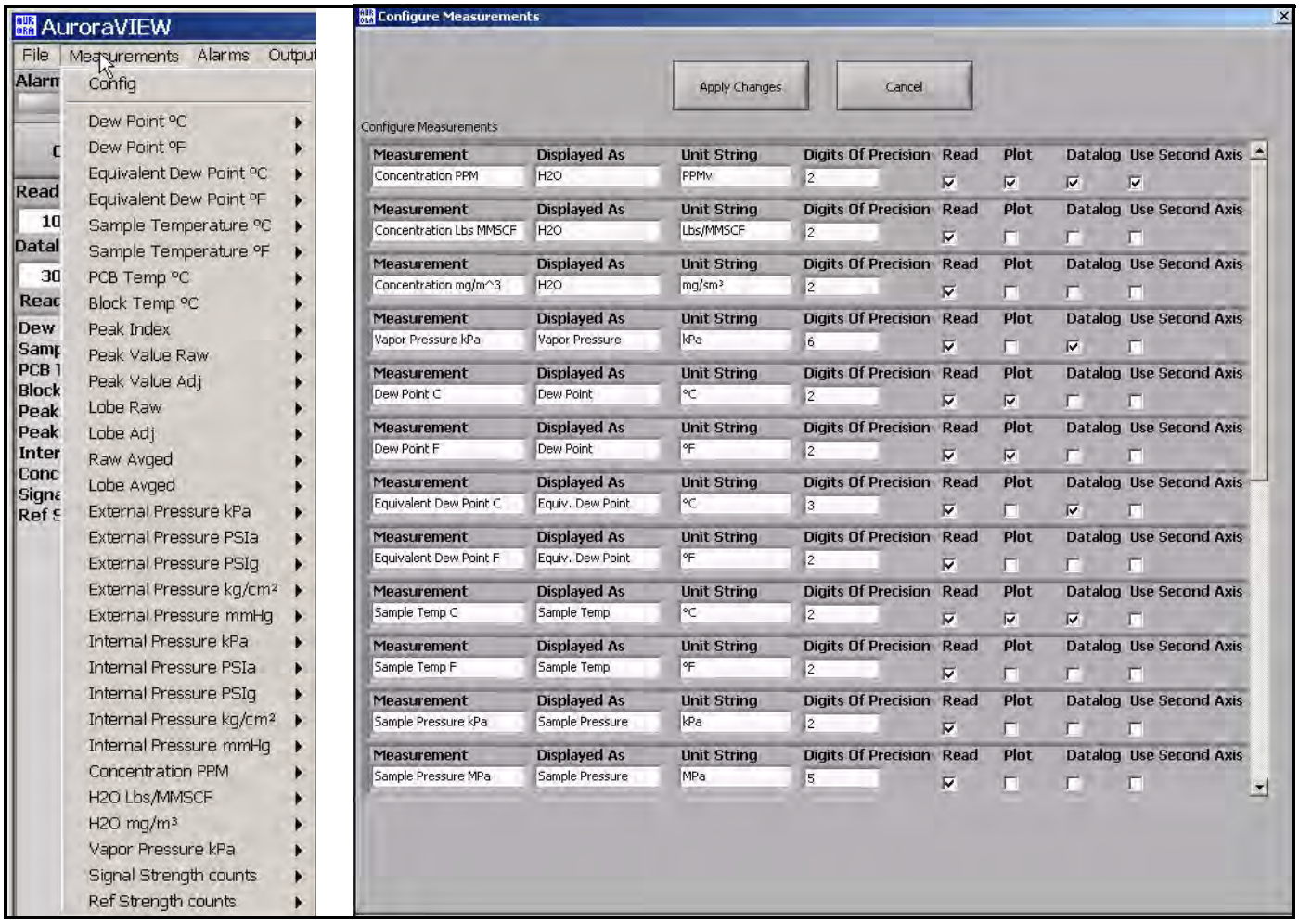


Figure 51: Configuration Measurements

- Unit String: Set this value to the value you want to read, plot or datalog.
- Digits of Precision: Set a numerical value (typically 0, 1, 2). This sets the resolution of the displayed measurement units to the right of the decimal place (i.e., “20.78” would result from a setting of “2”).
- Read: Check this box if you want to show the value in the current Readings pane.
- Plot: Check this box if you want to show the value in the Trend Plots graph AND the Trend Tabular Data tab.

5.5 Using the Main Menus (cont.)

Note: *The other options under MEASUREMENTS are for individual unit types and perform the same function as checking a box under the CONFIG pop-up window.*

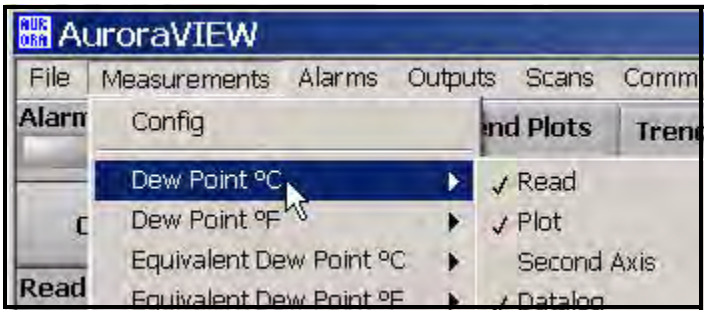


Figure 52: Other Measurement Options

2. Click Alarms → Config

This window enables the user to configure the alarm status within the **AuroraView** application. This feature allows you to remotely configure **Aurora H2O** alarms, which are used only with Modbus RTU digital output. The **AuroraView** Alarms are shown below.

Figure 53: Alarms Configuration

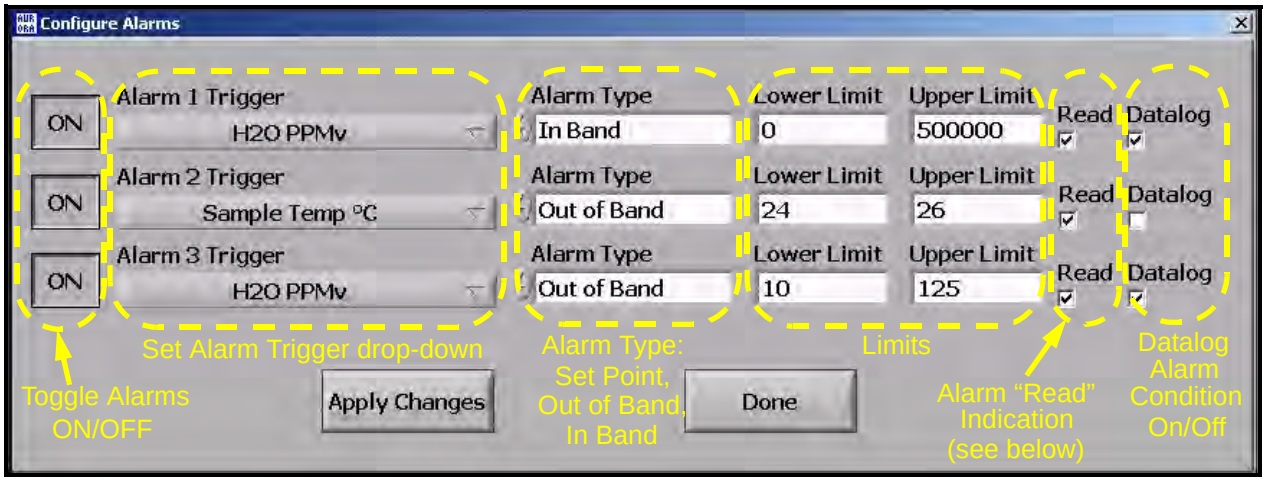


Figure 54: Other Measurements Options

Figure 55: Alarm Status Indicators

5.5 Using the Main Menus (cont.)

3. Click Outputs → Config

Figure 56: Outputs Configuration

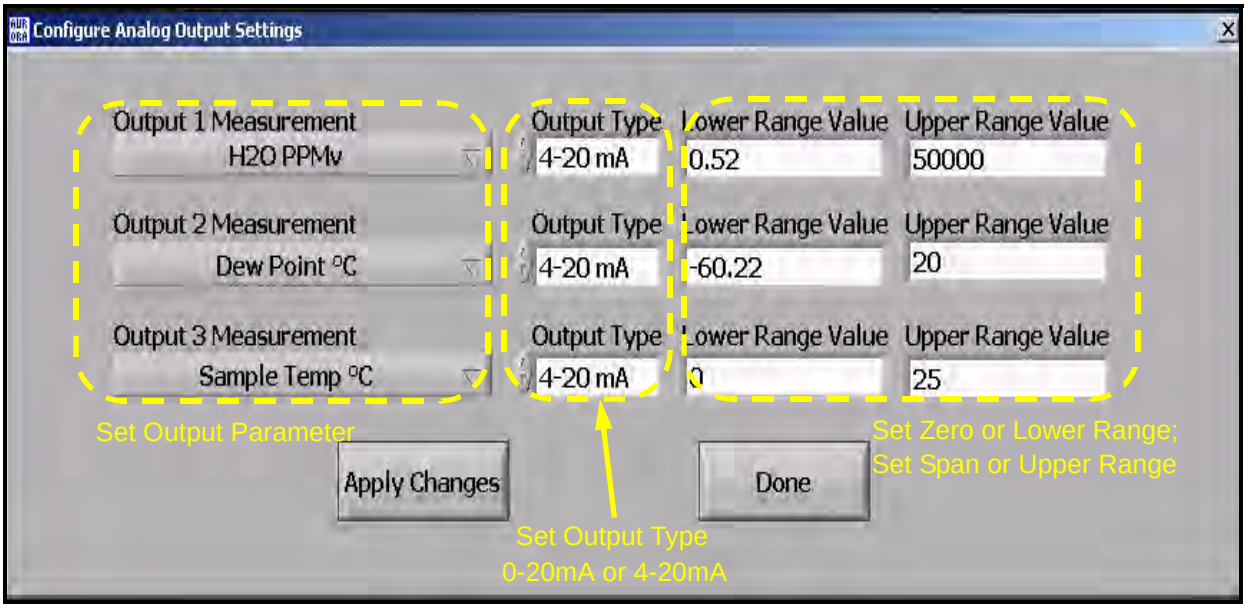


Figure 57: Other Output Options

5.5 Using the Main Menus (cont.)

4. Click Scan

This section will enable you to pick the type of scan you want to see. The default scan is the SPECTRA scan, which shows the 2f spectral scan. This is the processed signal waveform that the **Aurora H2O** uses to determine the moisture concentration. Viewing this scan may be helpful in certain troubleshooting situations. A typical 2f spectra scan is shown in Figure 59 on page 83. You may select the scan interval in minutes. This will be the refresh rate at which **AuroraView** updates the scan plot. To enter a scan interval, click on the Click to Save Scans Periodically button, and the following screen appears. Enter the interval and click on Continue to save or Cancel to reject the change.

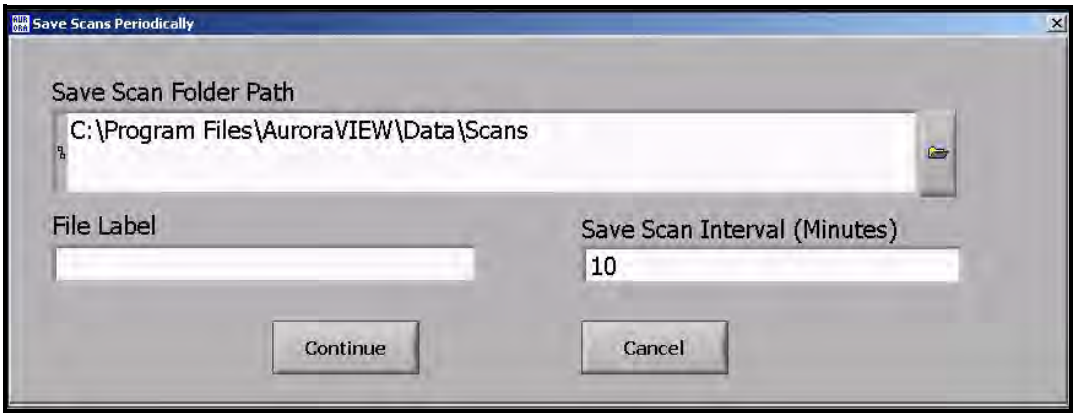


Figure 58: Save Scans Periodically

5.5 Using the Main Menus (cont.)

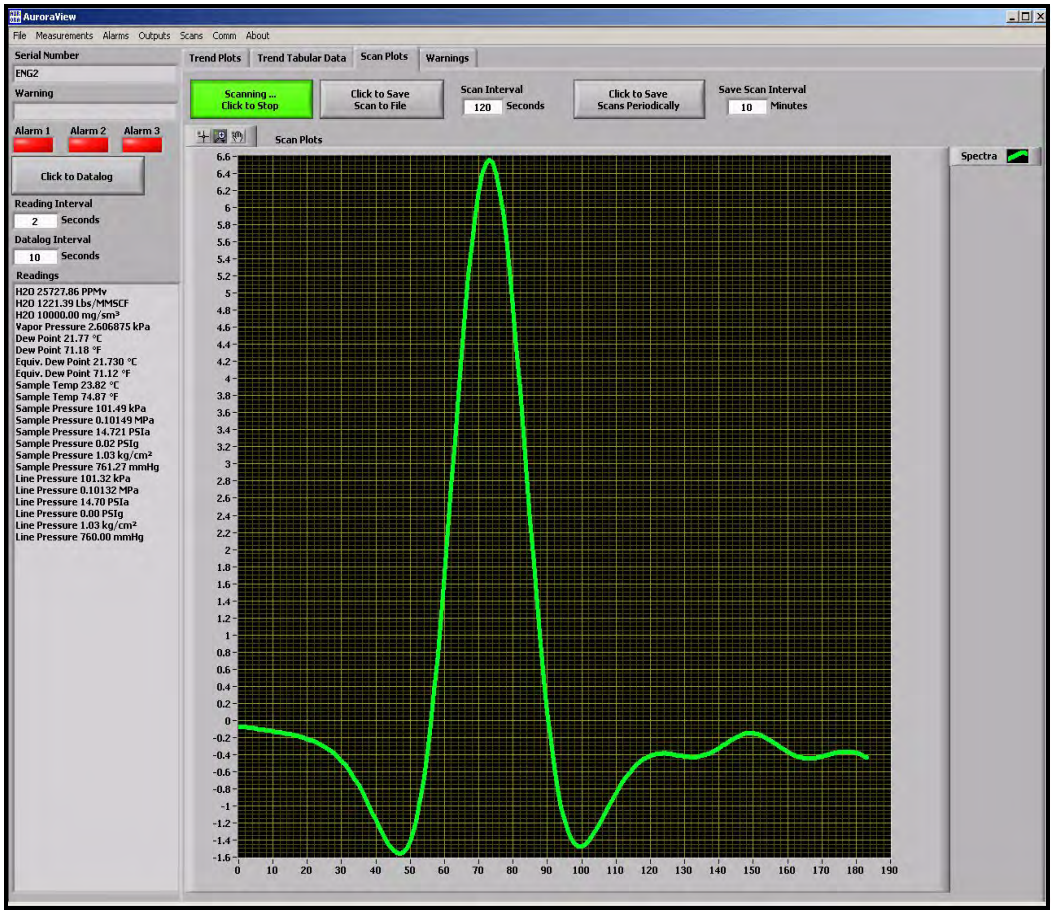

AuroraView
File Measurements Alarms Outputs Scans Comm About
Serial Number
ENG2
Warning
Alarm 1
Alarm 2
Alarm 3
Click to Datalog
Reading Interval
2 Seconds
Datalog Interval
10 Seconds
Readings
H2O 25727.86 PPMv
H2O 1221.39 Lbs/MMSCF
H2O 10000.00 mg/sm³
Vapor Pressure 2.606875 kPa
Dew Point 21.77 °C
Dew Point 71.18 °F
Equiv. Dew Point 21.730 °C
Equiv. Dew Point 71.12 °F
Sample Temp 23.82 °C
Sample Temp 74.87 °F
Sample Pressure 101.49 kPa
Sample Pressure 0.10149 MPa
Sample Pressure 14.721 PSIa
Sample Pressure 0.02 PSIg
Sample Pressure 1.03 kg/cm²
Sample Pressure 761.27 mmHg
Line Pressure 101.32 kPa
Line Pressure 0.10132 MPa
Line Pressure 14.70 PSIa
Line Pressure 0.00 PSIg
Line Pressure 1.03 kg/cm²
Line Pressure 760.00 mmHg
Trend Plots
Trend Tabular Data
Scan Plots
Warnings
Scanning ... Click to Stop
Click to Save Scan to File
Scan Interval
120 Seconds
Click to Save Scans Periodically
Save Scan Interval
10 Minutes
Scan Plots
Spectra
6.6 6.4 6.2 6 5.8 5.6 5.4 5.2 5 4.8 4.6 4.4 4.2 4 3.8 3.6 3.4 3.2 3 2.8 2.6 2.4 2.2 2 1.8 1.6 1.4 1.2 1 0.8 0.6 0.4 0.2 0 -0.2 -0.4 -0.6 -0.8 -1 -1.2 -1.4 -1.6
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190

Figure 59: Scan Plot Tab

5.5 Using the Main Menus (cont.)

5. Click Comms

This window enables you to configure communication options. If you have more than one **Aurora H2O** on your network, you will have to establish different NETWORK ID's for each analyzer using the main keypad on the **Aurora H2O**. For your PC system, you will have to select which comm port to use. This is typically COM1. The default baud rate is 115200 baud.

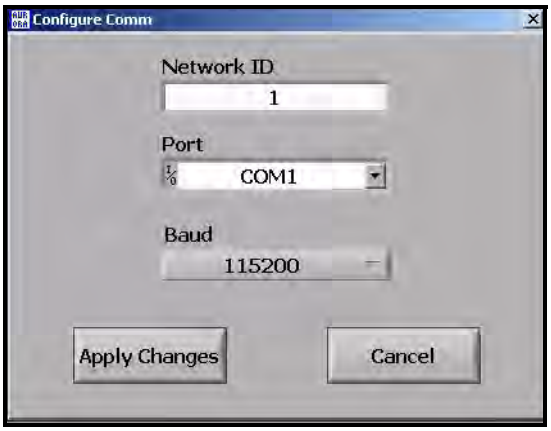


Figure 60: Configure Communication Options

6. Click Help

This screen indicates the revision level of **AuroraView**.

About AuroraView
GE
Sensing
AuroraView Instrument Interface Software
Copyright © 2008-2009 General Electric Company
Version 1 A
Warning: Copyright law and international treaties protect this computer program. Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.
OK

Figure 61: Software Information

5.6 Datalogging with AuroraView

1. In the main view, click on the button Click to Datalog.

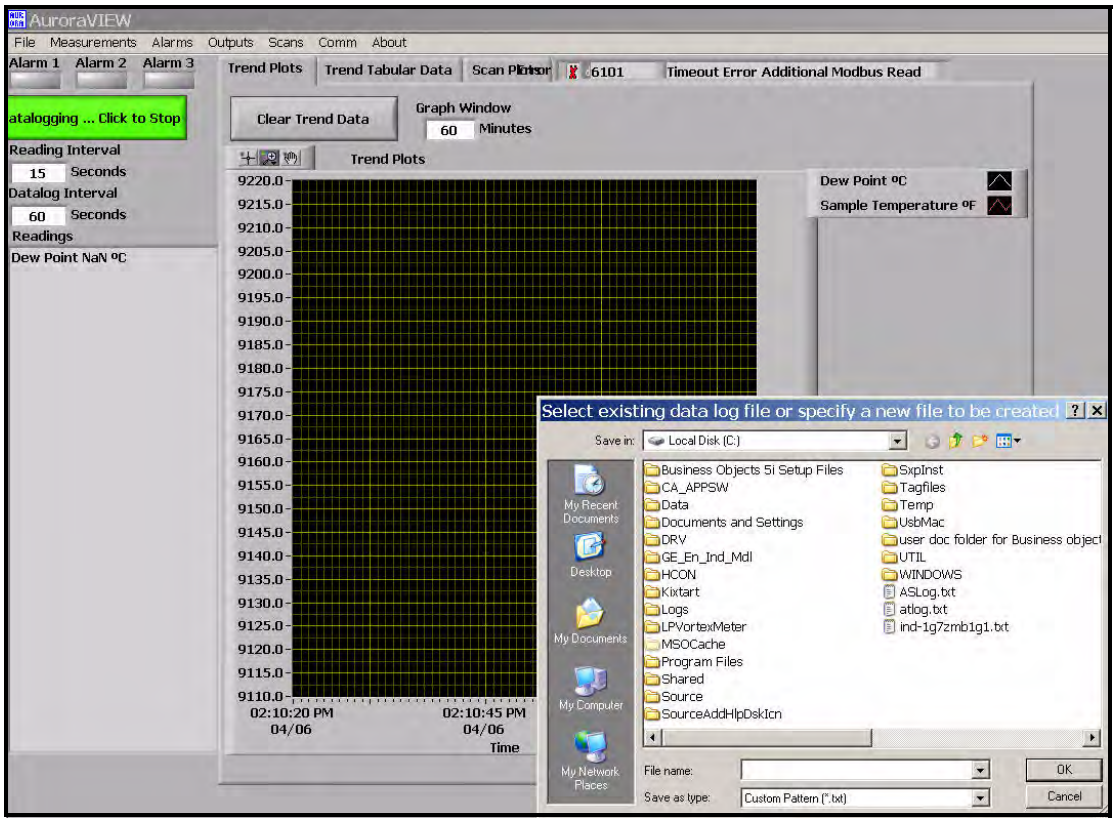


Figure 62: Datalogging with AuroraView

2. **AuroraView** will request a file location. Pick a file location and a file name to save your data log file. All data log files are comma delimited .txt files by default.
3. Once you pick a file location, **AuroraView** will write any parameter that has a check box with Datalog checked in the main Config window at the time interval set in the Datalog Interval box, and the button in the main window will change to Datalogging...Click to Stop.
4. When you are done datalogging, click the button to stop logging. You may now open your .txt datalog file in any application, such as Microsoft Excel, so that you can analyze that data.

Note: *When datalogging multiple parameters at intervals of five seconds or less, it is recommended to use baud rates of 57.6K or 115.2K.*

5.7 Working with Trend Plots, Trend Tabular Data & Scan Plots

1. Trend Plots is a powerful graphing feature in **AuroraView**. You can graph many parameters at the same time.

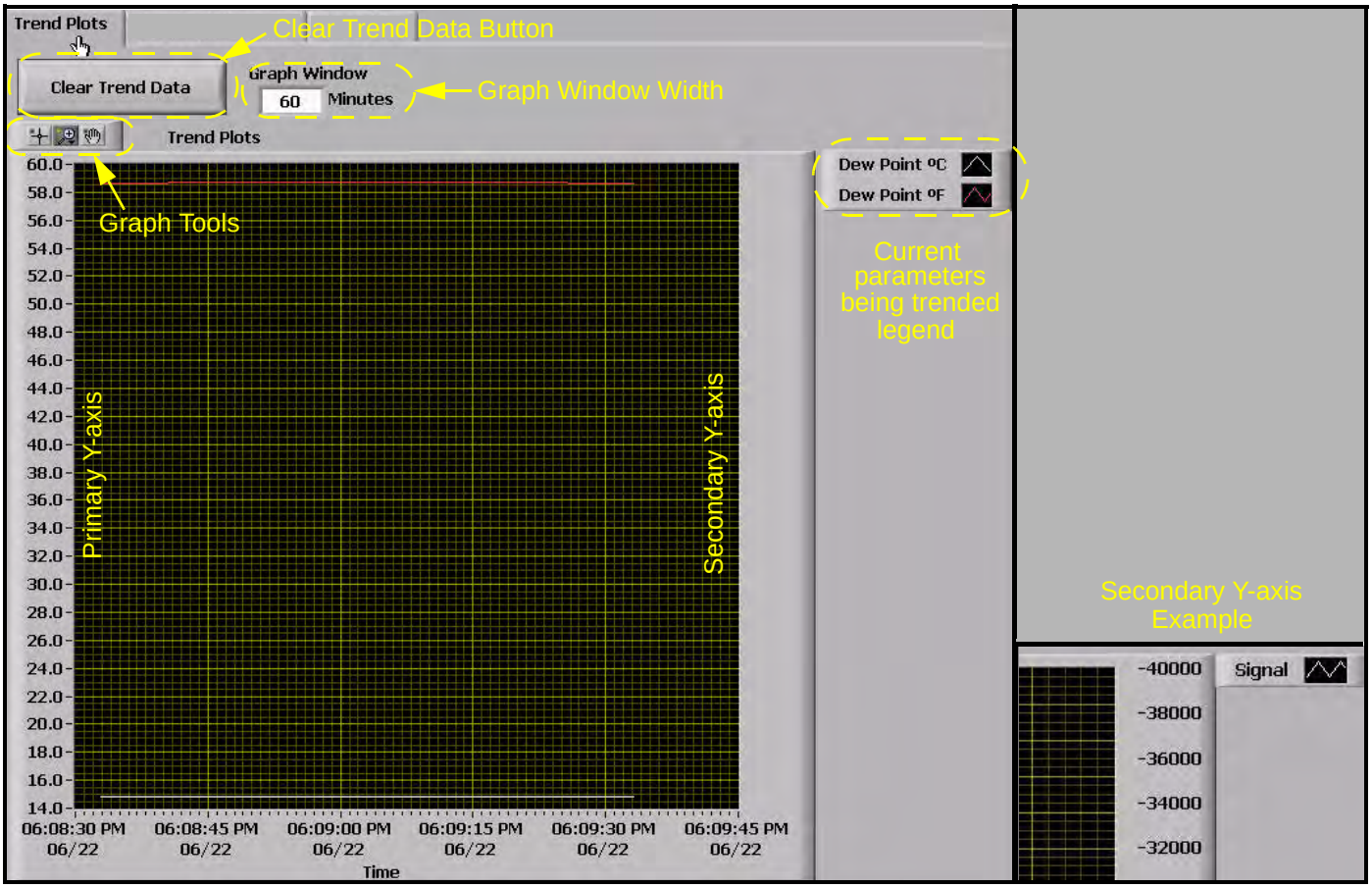


Figure 63: Using Trend Plots

Note: *If you use the secondary y-axis, you may see "–" tick marks preceding the value. These are tick marks from the graphical applet and not an indication of negative values.*

5.7 Working with Trend Plots, Trend Tabular Data & Scan Plots (cont.)

2. If you right-click on any series of data within the graph, or you click on the current parameter being-trended item in the legend, you will see a variety of options for graphing data. You can change to a variety of common plots and adjust color, line style, and line width. For some data sets with lots of finite points, you may want to click Anti-Aliased which will smooth the plot line. You can also change bar plots, fill base line, interpolation and point style. X-Scale adjusts the x-scale. Y-Scale adjusts the y-scale and enables the secondary y-axis.

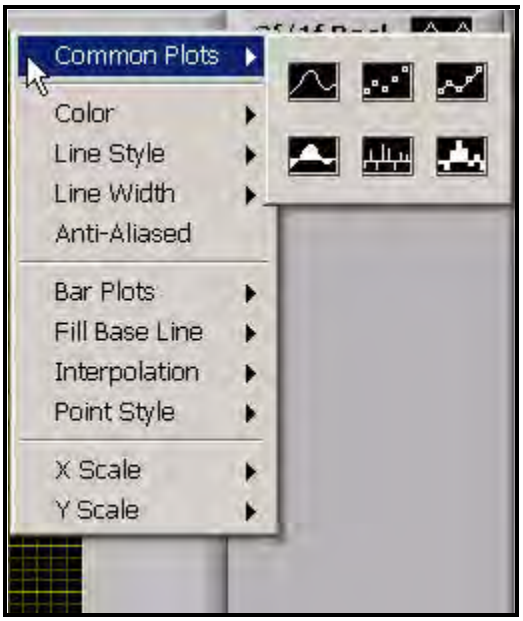


Figure 64: Options for Graphing Data

3. There is a series of Graph Tools available at the top left of the trend plot area.

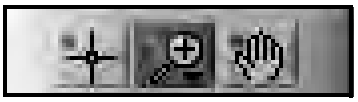


Figure 65: Graph Tools

- Pointer
- Zoom Tool - gives you six options as shown in Figure 66.

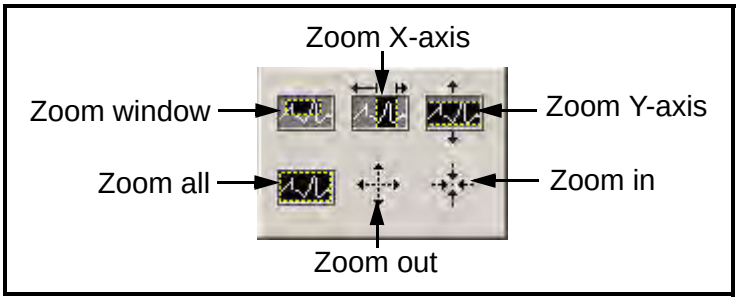


Figure 66: Zoom Tool

- Hand Tool - Enables you to graph the trend plot area and move it around without rescaling.

5.7 Working with Trend Plots, Trend Tabular Data & Scan Plots (cont.)

4. Copying and Pasting a Trend Plot can be done from **AuroraView**. One way to do this quickly is to simply right click over the data area and choose Copy. In another application, like Microsoft Word, simply paste.

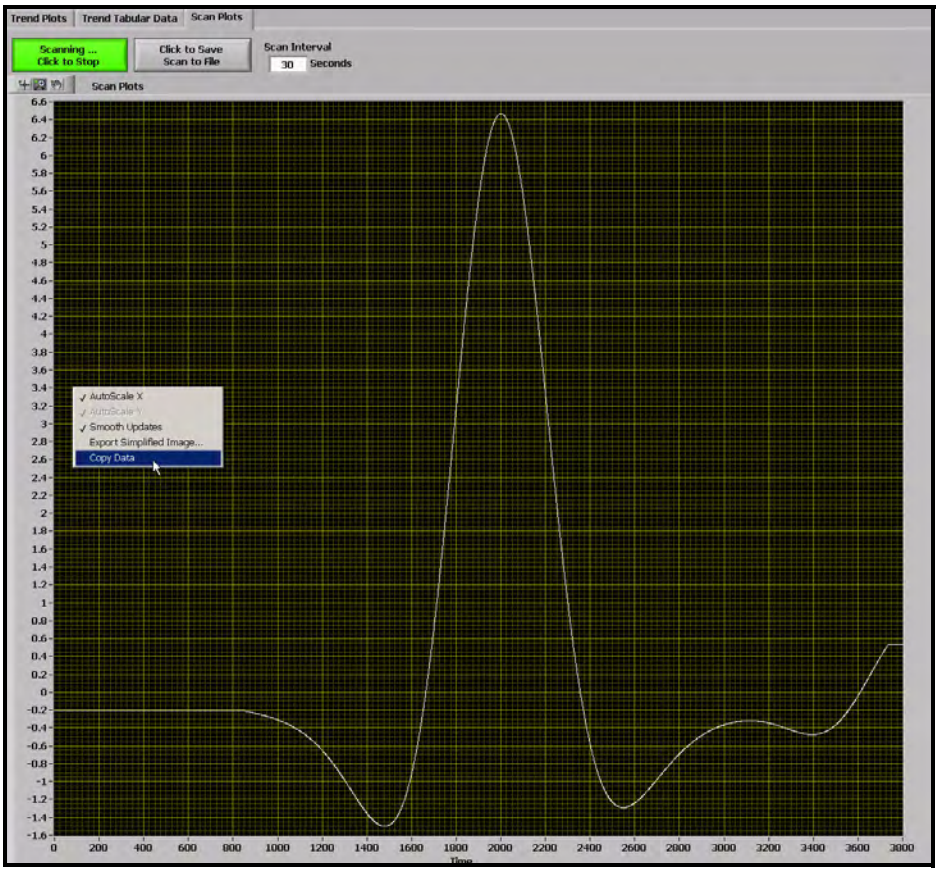


Figure 67: Copying a Trend Plot

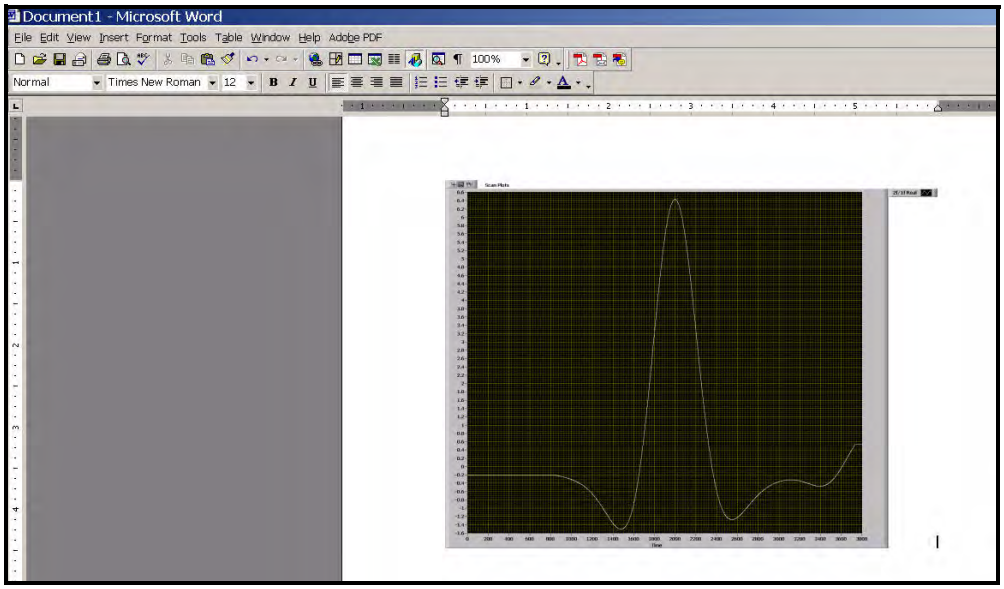


Figure 68: Pasting a Trend Plot

5.7 Working with Trend Plots, Trend Tabular Data & Scan Plots (cont.)

Another option is to right-click and chose the option Export Simplified Image. When you do this, a variety of image file formats will appear. A good universal option is Enhanced Metafile. Pasting an enhanced metafile will give you the ability to paste an image with an inverted color scheme as shown in the second example posted into Word (see *Figure 71 on page 90*).

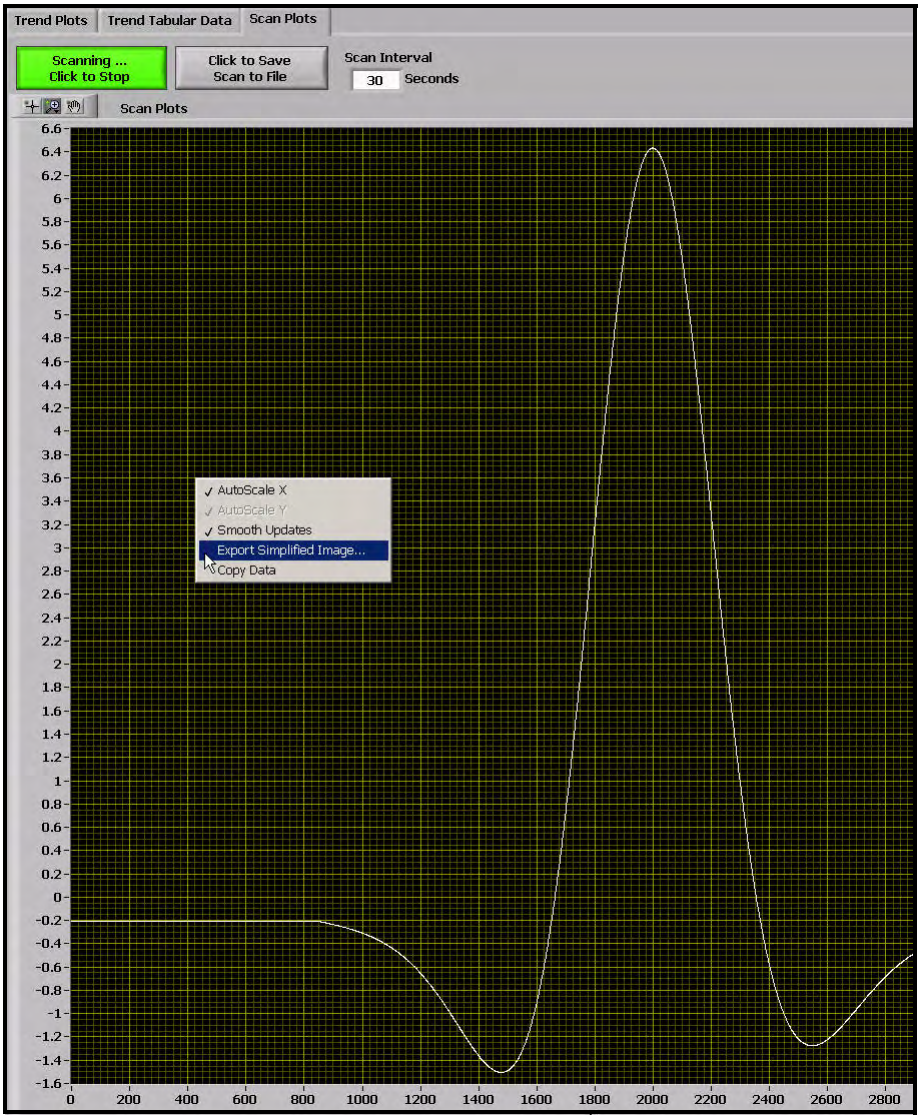


Figure 69: Exporting a Simplified Image

5.7 Working with Trend Plots, Trend Tabular Data & Scan Plots (cont.)

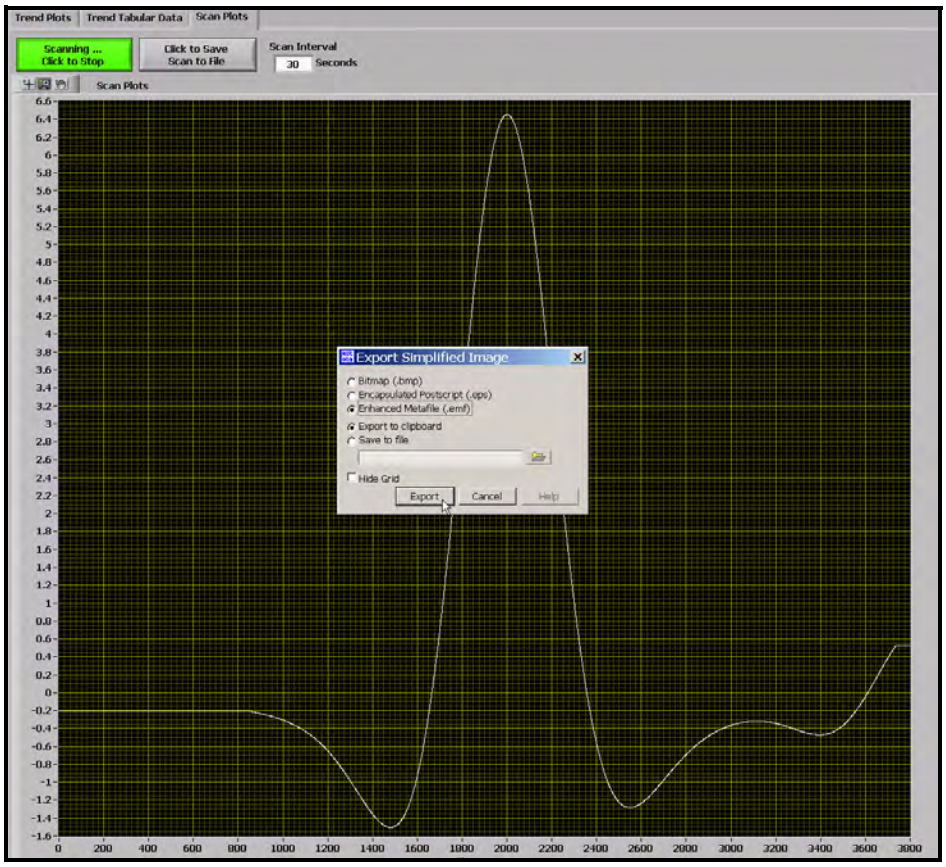


Figure 70: Selecting Enhanced Metafile

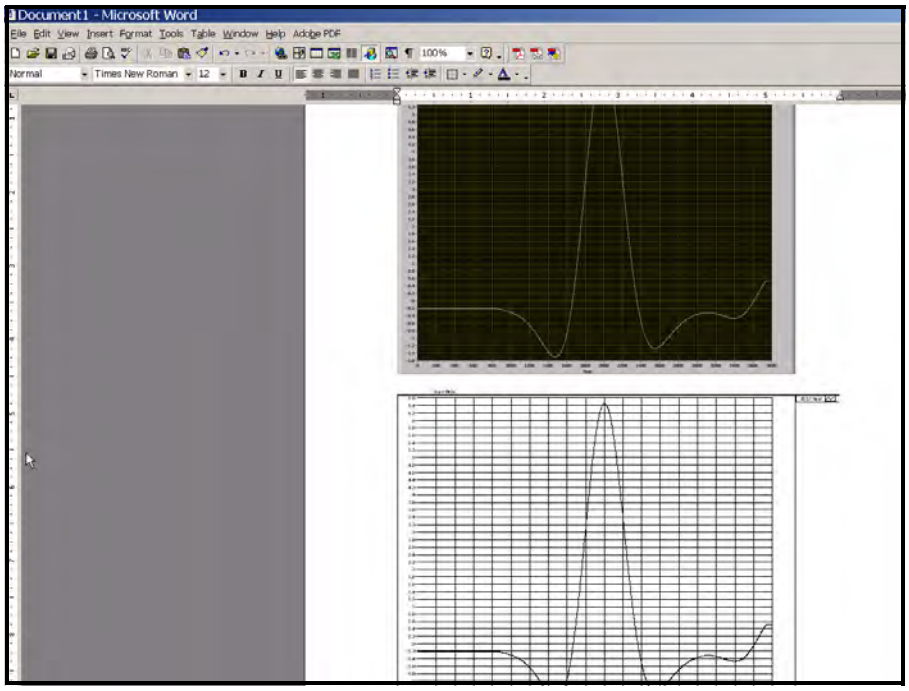


Figure 71: Pasting an Enhanced Metafile

5.7 Working with Trend Plots, Trend Tabular Data & Scan Plots (cont.)

Working with Trend Tabular Data, you will be able to see data in tabular format as shown in *Figure 72* below. You can adjust column widths to see data more easily with full titles in the header row.

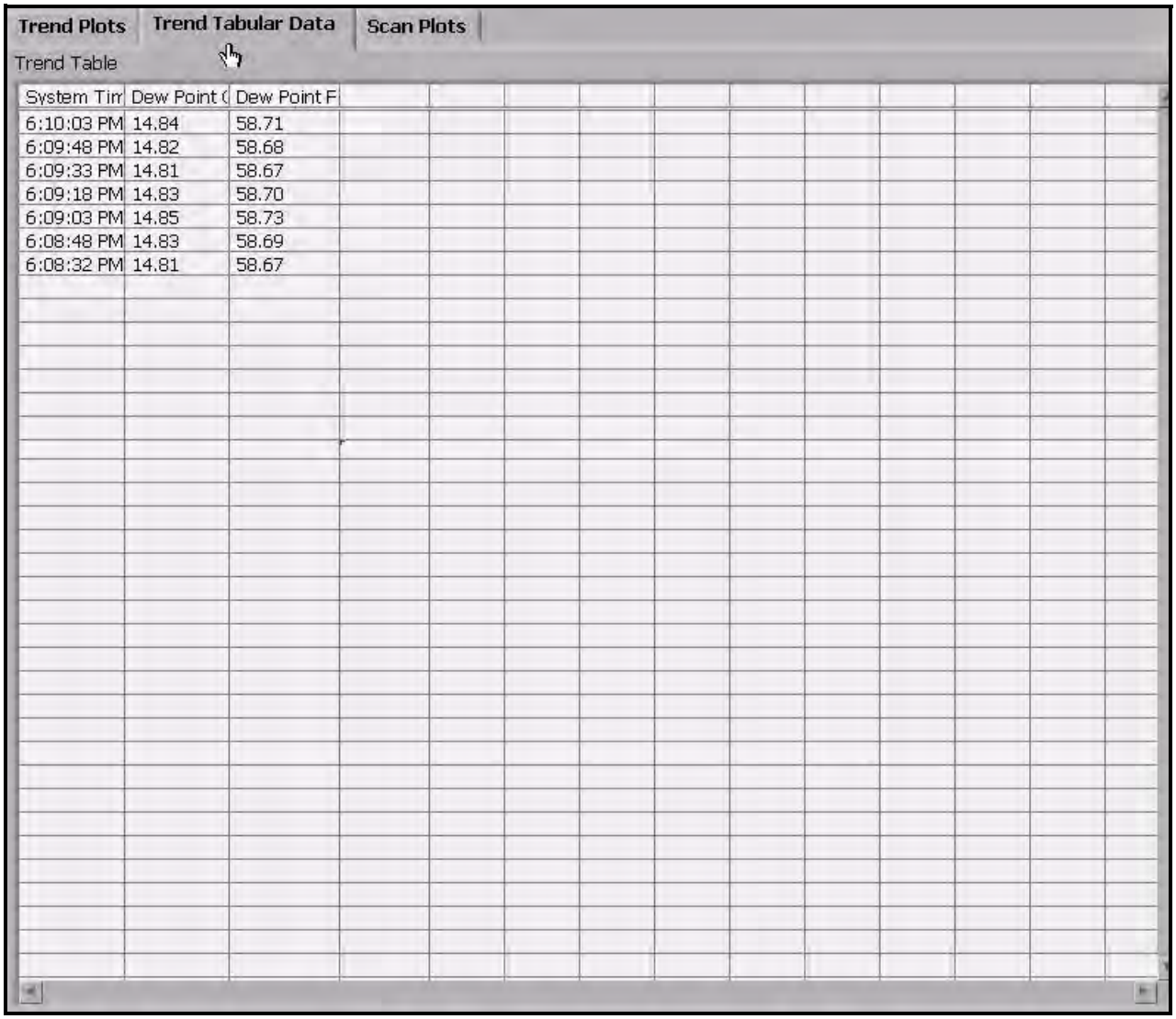
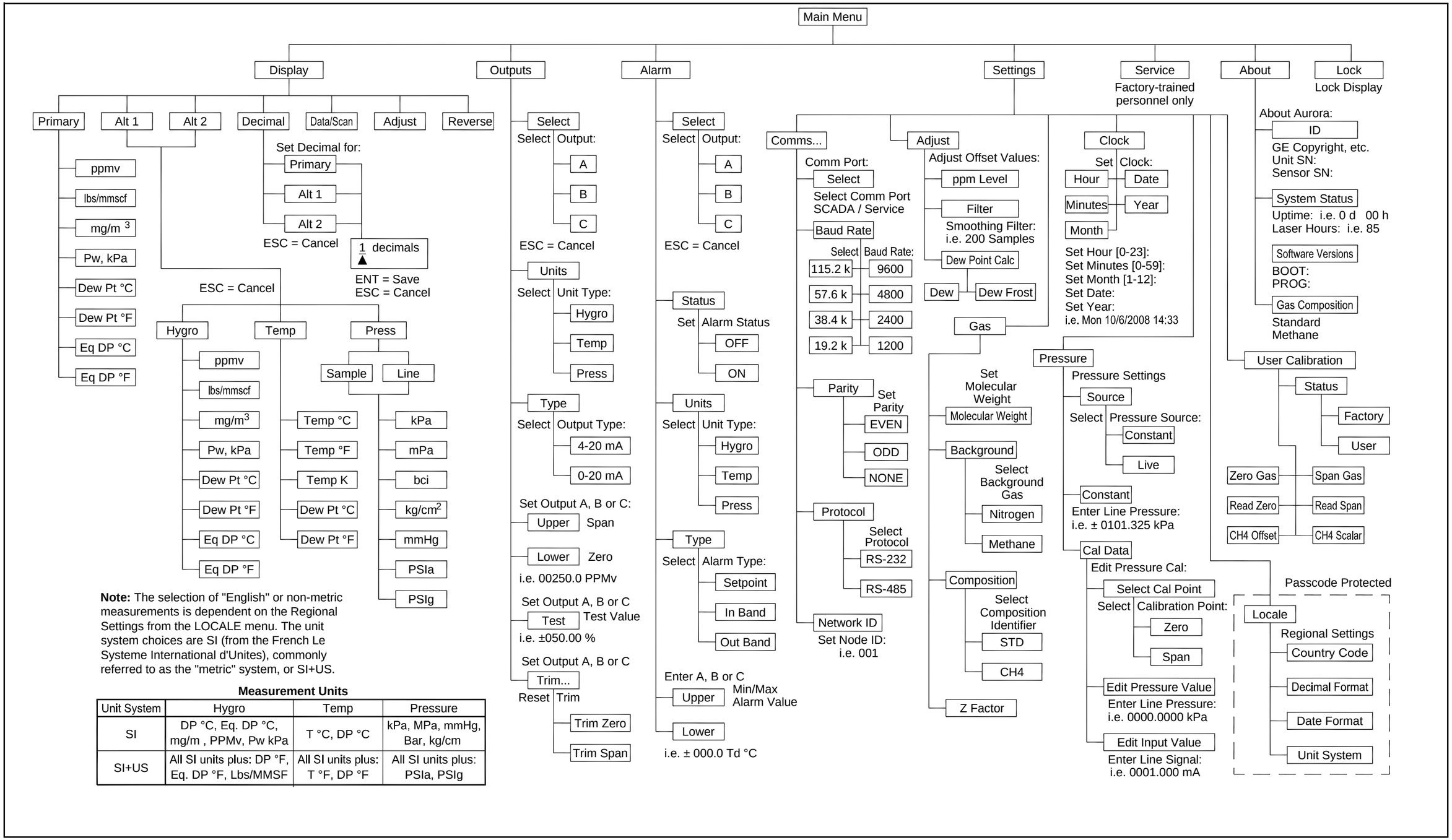


Figure 72: Trend Data in Tabular Format

[no content intended for this page]



Note: The selection of "English" or non-metric measurements is dependent on the Regional Settings from the LOCALE menu. The unit system choices are SI (from the French Le Systeme International d'Unites), commonly referred to as the "metric" system, or SI+US.

Measurement Units

Unit System	Hygro	Temp	Pressure
SI	DP °C, Eq. DP °C, mg/m , PPMv, Pw kPa	T °C, DP °C	kPa, MPa, mmHg, Bar, kg/cm
SI+US	All SI units plus: DP °F, Eq. DP °F, Lbs/MMSF	All SI units plus: T °F, DP °F	All SI units plus: PSIa, PSIg

Figure 73: Programming Menu Map

[no content intended for this page]

Chapter 6. Maintenance

CAUTION! CLASS 1M INVISIBLE LASER RADIATION WHEN OPEN. DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.

WARNING! Use of controls or adjustments or performance of procedures other than those specified herein may result in radiation exposure that is more hazardous than specified.

6.1 Spare Parts

Table 3: Aurora H2O Spare Parts List

Part No.	Description	Qty.
704-688-12	RS-232 Cable; SUB-9-F to Tinned Leads; 12 ft.	1
Aurora H2O Maintenance Kit		
N/A	Plastic Case with Foam Inserts	1
421-3230	Magnetic Stylus	1
240-199	Air Blower	1
403-161	Lens Tissue Package	1
463-030	Replacement Membrane Filter Elements	5
240-201	Allen Wrench, 5/32"	1
240-200	Allen Wrench, 3/32"	1
S40046393	Small Screw Driver	1
403-163	Gloves	4

6.2 Recommended Factory Verification Period

Aurora H2O technology is designed for long life without calibration. There are no wetted sensing surfaces, which might degrade over time due to direct sample gas contamination. The optical components are designed to be stable over the span of many years. GE recommends that **Aurora H2O** analyzers may be returned to the factory for verification on a five (5) year periodic basis. GE will inspect, clean, replace filter elements and calibrate the unit to traceable standards as part of the factory service for **Aurora H2O** analyzers.

6.3 Cleaning the Mirror

The **Aurora H2O** analyzer may provide the message Weak Signal Return - Check Mirror on the top line of the display, along with the red light "!" to the left of the main display. If this occurs, the mirror and/or the optical window of the measuring cell may be contaminated due to liquid or particulate coating/deposition.

Note: *Reagent grade Acetone (Cas no. 67-64-1) may be needed for the cleaning process. The reagent is not supplied as part of the Aurora maintenance kit, and you must obtain the reagent from a local chemical supplier.*

6.3 Cleaning the Mirror (cont.)

If the error condition Check Mirror is indicated, the first step is to clean the mirror. The process is as follows:

1. Turn the power to the **Aurora H2O** OFF.

CAUTION! CLASS 1M INVISIBLE LASER RATIATION WHEN OPEN. DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS.

WARNING! Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous laser exposure.

2. Shut down the flow through the measuring cell.
   a. Turn the inlet isolation ball valve (item 4 in *Figure 2 on page 4* or *Figure 3 on page 5*) to the closed position.
   b. Ensure that the sample flow rotatmeter indicates zero flow.
3. Wear a pair of disposable latex gloves.

Note: *A 5/32 inch allen wrench is required to accomplish this task.*

4. Remove the 6 hex bolts securing the mirror (see *Figure 74* below). A 5/32 inch allen wrench is required to accomplish this task. Hold the stainless steel base of the mirror with one hand while removing the last retaining bolts. The mirror is removed by pulling it straight down. There is one alignment pin to facilitate proper removal.

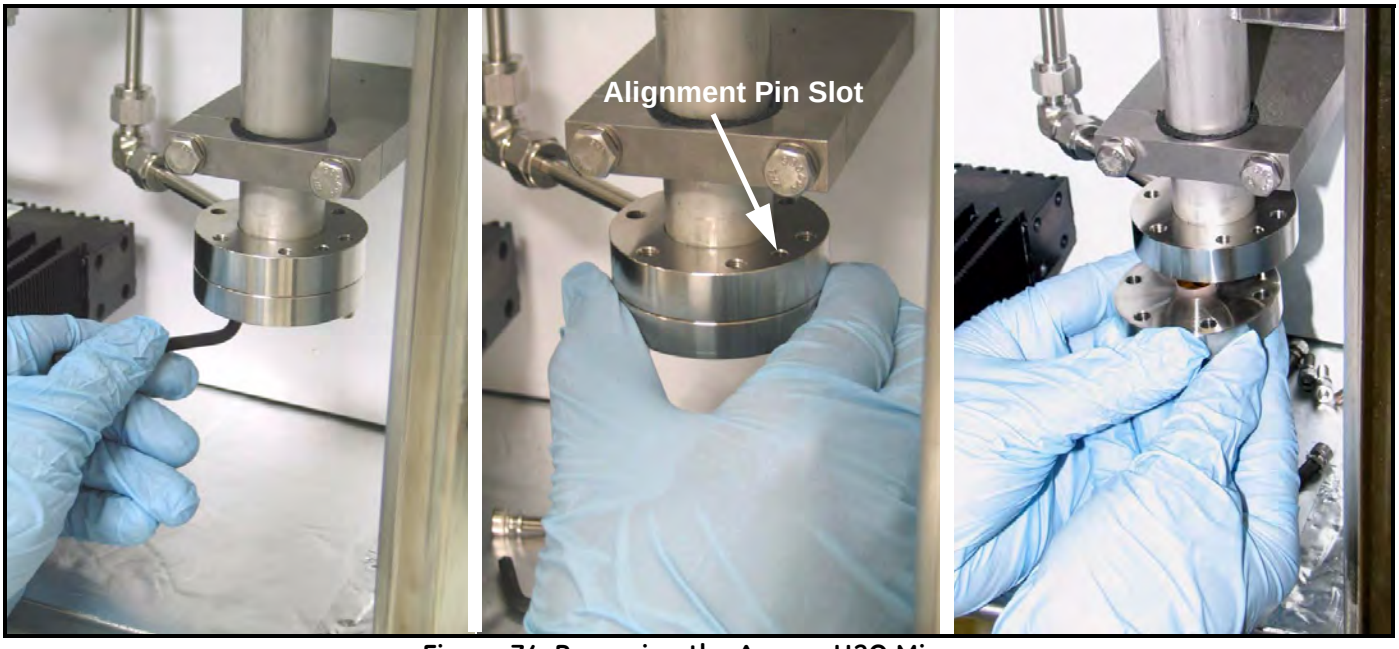


Figure 74: Removing the Aurora H2O Mirror

6.3 Cleaning the Mirror (cont.)

CAUTION! **Handle the mirror with extreme care. Performance of the analyzer is dependent upon the mirror integrity. Do not touch the mirror surface with any tools, objects, hands or fingers.**

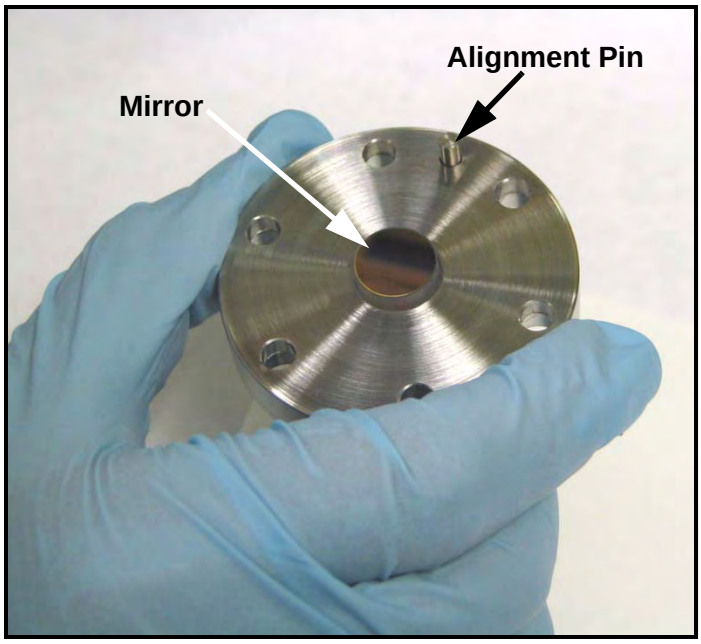


Figure 75: Handling the Mirror Assembly

5. Make a visual inspection of the mirror surface. Record any observation of gross contamination. If the mirror appears to be clean, do not clean it. Instead, reinstall it into the system.

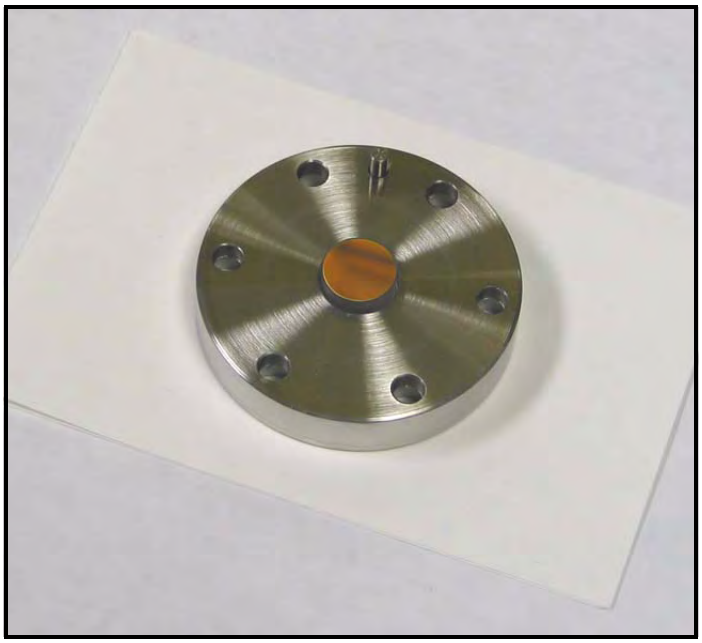


Figure 76: Examining the Mirror

6.3 Cleaning the Mirror (cont.)

6. If the mirror is contaminated, the first step in cleaning it is to use the air blower to blow away any particulate matter on the mirror surface. Place the mirror assembly on a flat surface and repeatedly puff the air blower to force dry clean air onto the mirror surface (see *Figure 77* below).

Figure 77: Blowing Air onto the Mirror

7. Using a piece of lens tissue, wet a small area with a very small amount of **analytical grade acetone** (barely wet the lens tissue). Typically, one drop of acetone will suffice. Tilt the lens tissue so that the acetone drop is absorbed by the lens paper along the length of the piece (see *Figure 78* below).

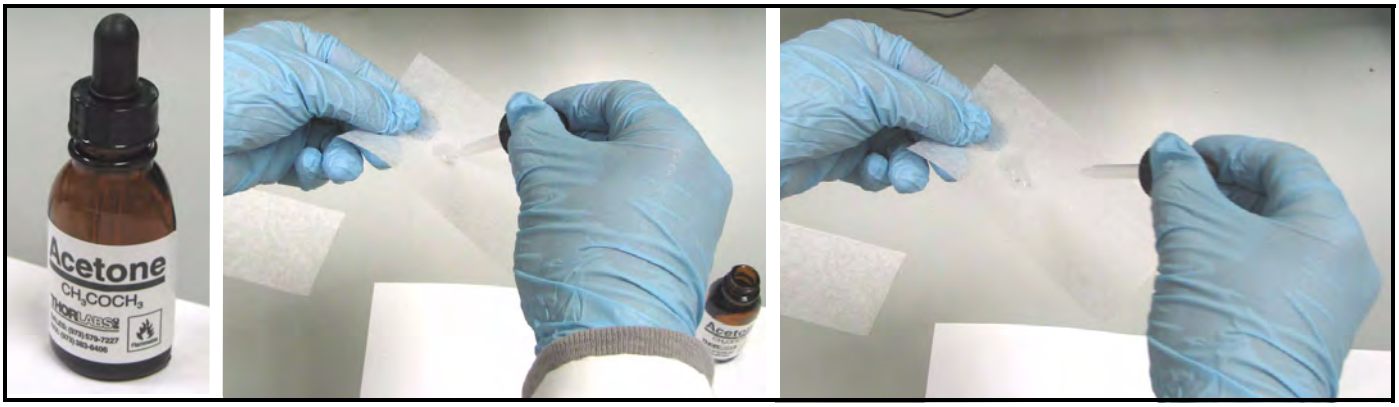


Figure 78: Using Analytical Grade Acetone

6.3 Cleaning the Mirror (cont.)

8. Place the wet lens tissue on top of the mirror and drag it horizontally across the surface of the mirror (see *Figure 79* below).

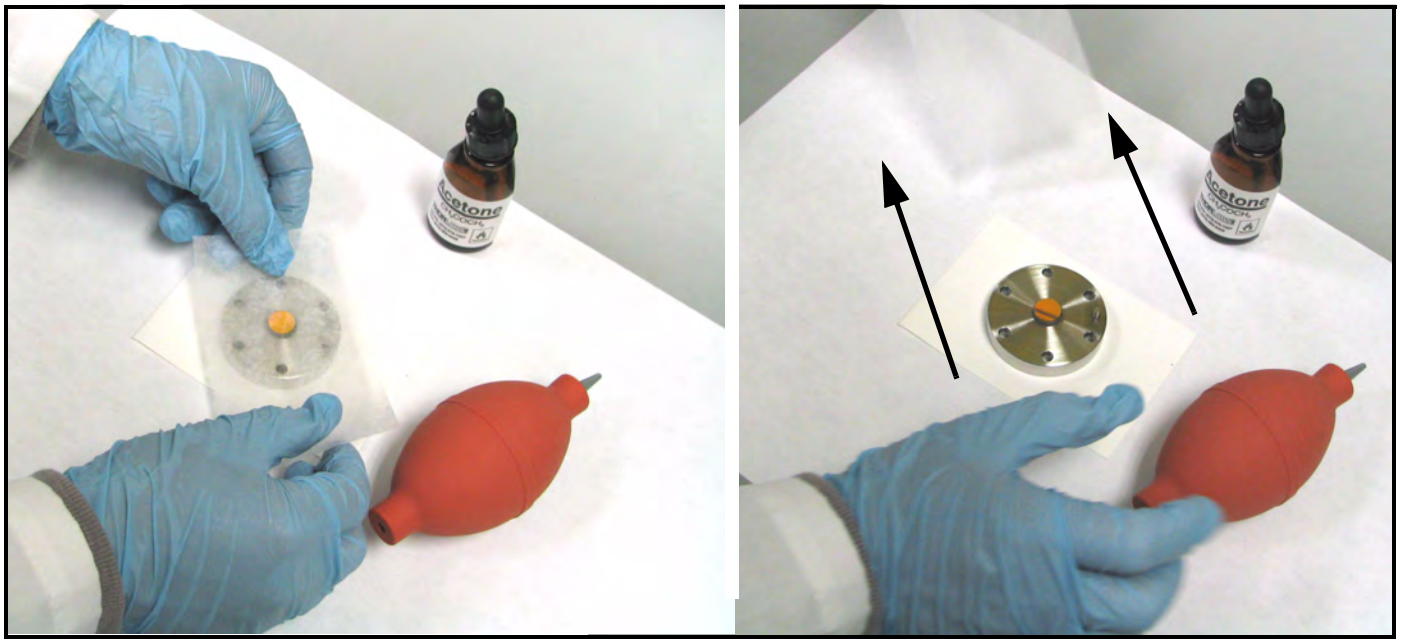


Figure 79: Dragging the Wet Lens Tissue Across the Mirror

9. Use the air blower to blow dry air onto the surface of the mirror. Puff repeatedly until the mirror surface appears dry (see Figure 80 below).

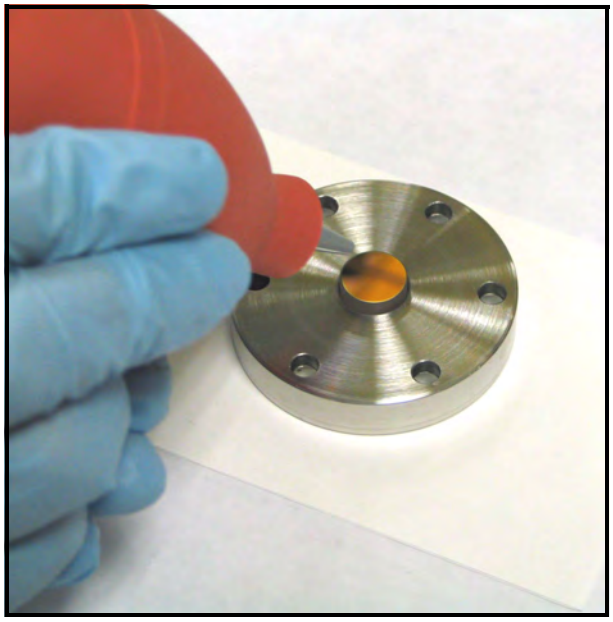


Figure 80: Drying the Mirror

6.3 Cleaning the Mirror (cont.)

10. Repeat steps **7-9** at least three times, using a new lens tissue each time.

11. Visually inspect the mirror, and record any observation of gross contamination.

12. If the mirror does not appear to be clean, contact GE for further assistance.

13. If the mirror does appear to be clean, re-install it onto the measurement cell.

14. As you line up the mirror to the measurement cell, note the "key" for properly connecting the two pieces. The mirror will align for mounting in only one position. Rotate the mirror assembly to line up the alignment pin with the alignment pin slot (see *Figure 81* below).

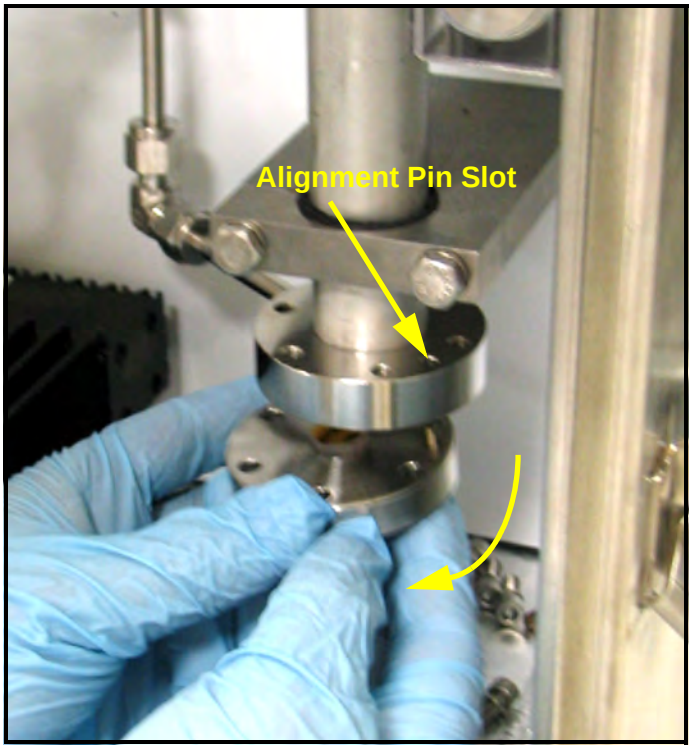


Figure 81: Reinstalling the Mirror Assembly

15. Loosely reinstall the six retaining bolts by hand.

16. Use an Allen wrench to tighten the six retaining bolts in an alternating or star pattern to achieve a uniform metal-to-metal contact. Tighten the bolts just until they are snug - **DO NOT** overtighten these bolts.

17. Re-establish power to the **Aurora H2O** analyzer.

18. Re-establish the flow through the sample system.

19. If the **Aurora H2O** still indicates a Check Mirror, contact GE for further assistance.

6.4 Replacing the Filter Element

The **Aurora H2O** uses a membrane filter (see photograph to the left) as the secondary filter. This filter is intended to prevent liquid or particulate contamination from entering the absorption cell. The Aurora should not be operated without a filter train upstream of the unit. The membrane filter is equipped with *"Flow Block"* which shuts off the flow if the filter element is heavily loaded with contamination. A spring loaded check valve closes the outlet flow of the sample if the differential pressure across the filter element exceeds a threshold limit. At any given time the flow through the **Aurora H2O** can be checked by observing the rotameter. If the *"flow block"* feature shuts off the flow, do not increase the pressure. Replace the filter element and clean the filter.

If the flow is being shut off too frequently, additional sample condition schemes, or the combination of the following, will have to be employed:

- **Bypass flow** - needed to sweep liquids or contamination off the filter. A 10:1 bypass flow rate should be maintained.
- Additional upstream filtration
- **Heat** – Heat tracing of the sample line and sample system components, sufficiently above both the water and hydrocarbon dew point, will keep the sample in the gas phase.

To replace the filter element, complete the following steps:

1. Close the inlet isolation ball valve and allow the system to fully depressurize.
2. Turn the filter cap counter-clockwise (see *Figure 82* below). You might need to use a channel-lock wrench to assist in loosening the cap.

Figure 82: Removing the Filter Cap

6.4 Replacing the Filter Element (cont.)

3. Place the filter cap on a horizontal flat surface, filter side up.

4. Carefully remove the large O-ring.

Note: *Because the O-rings are reused, replacement O-rings are not included in the maintenance kit.*

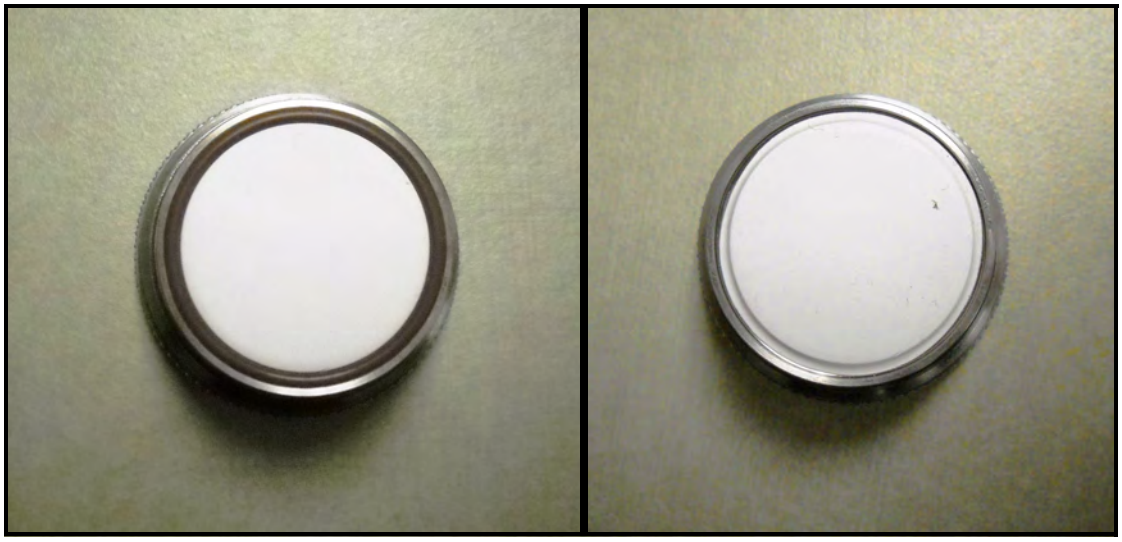


Figure 83: Orient the Filter Cap and Remove the Large O-Ring

5. Remove the white membrane filter element and the membrane backing plate.

Figure 84: Remove the White Filter Element and the Backing Plate

6.4 Replacing the Filter Element (cont.)

6. Remove the small O-ring.

Figure 85: Remove the Small O-ring

7. Using a tissue, clean the filter components.

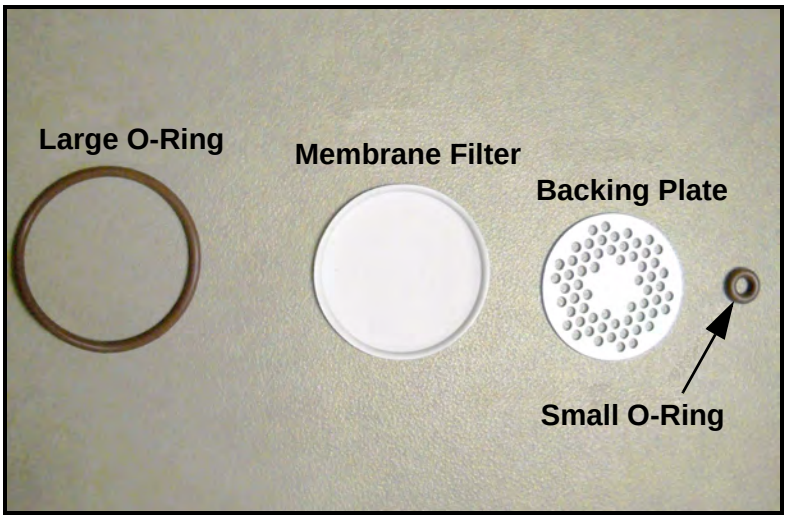


Figure 86: O-Rings, Membrane Filter and Backing Plate Removed

8. Re-assemble the filter, and reinstall the cap hand–tight.

[no content intended for this page]

Chapter 7. Troubleshooting

7.1 Introduction

The following are possible **Aurora H2O** analyzer conditions with details on how to deal with them.

7.2 Blank Display

1. Is the green POWER LED lit?
   a. Yes - proceed to **Step 2**.
   b. No - Check the wiring and the fuse
2. Are the four arrow keys illuminated?
   a. Yes - If the keys remain illuminated for more than 12 seconds, the *Boot Loader* cannot find a valid *Instrument Program* to run.
   b. No - contact the factory for service.

7.3 Display Dim or Hard to Read

1. Adjust the LCD brightness and contrast using the Display/Adjust menu.

7.4 Status Messages and Indicators

1. The **Aurora H2O** categorizes status messages as either *Faults, Warnings, or Information*. Status messages are displayed in the upper right corner of the display. Messages that are longer than the message area continuously scroll from right to left.
2. A **fault** is a non-recoverable condition that can affect the quality of measurement by the **Aurora H2O**. Fault messages are accompanied by a slow flashing (**!**) indicator.
3. A **warning** is a recoverable condition that can affect the quality of measurement by the **Aurora H2O**. Warning messages are accompanied by a rapid flashing (**!**) indicator.
4. **Information** messages alert the operator to a condition that is abnormal, but does not affect the quality of measurements. Information messages are accompanied by a slow flashing (**i**) indicator.
5. **Aurora H2O** fault and status messages are prioritized; in case of more than one fault/status condition, the condition with the highest priority is displayed. When that condition is resolved, the next highest priority condition is displayed.

7.4 Status Messages and Indicators (cont.)

Table 4: Status Messages and Indicators

Message	Condition	Description
Status OK	Info	**Aurora H2O** is operating normally, no faults or other indications.
No CH4 detected	Info	**Aurora H2O** is reading moisture, but cannot detect the presence of methane.
H2O Under Range	Info	The moisture level is below the system detection limits.
Warning - System Overheating	Fault	The temperature inside the electronics module exceeds 85°C or the air temperature inside the sample system enclosure exceeds 68°C. The laser is powered off until the electronics module temperature is below 80°C, and the sample system enclosure temperature is below 65°C.
FAULT: Temperature	Fault	The temperature transducer is operating out of limits, is disconnected, or has failed.
FAULT: Sample Pressure	Fault	The internal (sample) pressure transducer is operating out of limits, is disconnected, or has failed.
FAULT: Line Pressure	Fault	The external (line) pressure transmitter is operating out of limits, is disconnected, or has failed. Occurs if source of the line pressure measurement is set to "Live", and no pressure transmitter is attached.
Laser Temp Unstable...	Warning	The temperature of the laser is not stable. This warning occurs briefly at power on, as the **Aurora H2O** sets the correct operating temperature. The laser is powered off until the temperature has stabilized.
Laser Adjust at Limits	Info	**Aurora H2O** has reached the limit for adjusting the laser power. Contact the factory for assistance.
Laser Reference Fail	Fault	**Aurora H2O** could not detect any signal from the laser. Contact the factory for assistance.
Weak Signal Return - Check Mirror	Info	**Aurora H2O** could not detect a signal returned from the sample cell, or the signal is below allowed limits. Check mirror for contamination.
FAULT: TEC FAIL	Fault	**Aurora H2O** has detected a failure in the laser temperature control. Contact the factory for assistance.
WARNING - Sample Pressure TOO HIGH	Warning	The pressure in the **Aurora H2O** sample cell is greater than 212 kPa (30.75 psia). Verify regulator and flow settings; check for blocked vent line or excessive back pressure.
ERROR: TEC Setpoint out of Range	Fault	The **Aurora H2O** temperature controller is was set beyond its operating limits. Contact the factory for assistance.
Service Req: ###	Fault	**Aurora H2O** has detected a fault condition that has no associated status message. Contact the factory for assistance.

7.5 No Flow Measurement Indicated on Aurora H2O Measurement Cell Outlet

Check to make sure that the outlet of the **Aurora H2O** is venting to atmospheric pressure. Ensure that the sample system valves are configured correctly and that the **Aurora H2O** internal pressure regulator is capable of a barely positive pressure setting. Check/Replace the filter element in the coalescer/filter as detailed in Chapter 5, *Maintenance*.

7.6 Verifying Aurora H2O Performance in the Field

There are two methods for verifying the performance of the **Aurora H2O** in the field. The first method is to use a portable hygrometer such as *GE's PM880* portable hygrometer. The second method is to use a moisture generator or standard gas cylinder.

7.6.1 Using A Portable Hygrometer

One quick spot check that can be done, that is relatively easy to do and requires minimal set-up time and no consumables, is to use a second hygrometer. *GE* recommends using a *PM880 Portable Hygrometer* for this requirement with a recently calibrated *Aluminum Oxide Moisture Probe*.

Figure 87: PM880 Portable Hygrometer

The *PM880* can be connected to the outlet of the **Aurora H2O** analyzer, using the portable sample system with the aluminum oxide moisture probe, to verify the system. The response time of the portable hygrometer is limited, as the sensor is typically exposed to air during movement to the sample point. So, it is recommended that the sample gas remains flowing through the portable sample system on the sample outlet of the **Aurora H2O** until equilibrium with the moisture concentration of the sample gas is reached. You can use the data-logging capability of the PM880 to determine when steady-state conditions are reached. Consult *GE* if you have application questions regarding this process.

7.6.2 Using a Moisture Standard

The best moisture standard to use is one generated by a moisture generator as a flowing reference, due to the fact that static moisture standards in cylinders have limited capability and reliability. A moisture generator such as *GE's MG101* moisture generator can be used for this purpose.

Figure 88: MG101 Moisture Generator

However, a moisture generator is typically used only in an indoor location with reasonably good temperature control. In the field this is not always practical, so a more convenient option would be to use a static moisture standard in a gas cylinder. Consult with your local specialty gas supplier about standards for moisture. Based on application experience, GE recommends the following guidelines regarding moisture standards in gas cylinders:

- Use passivated, aluminum gas cylinders only.
- Do not use the cylinder when the pressure falls below 50% of the original pressure supplied by the vendor (typically 1500-1800psig).
- Use the gas cylinder for moisture values of 50–100 ppm.
- Use a moisture standard having a background gas of nitrogen (N2).
- Mix the moisture standard for 10 minutes prior to use, following the manufacturer's guidelines (rolling the cylinder is typical).
- Use the gas cylinder at the nominal temperature at which the cylinder was tested by the manufacturer.

Whether using a moisture generator or a standard moisture gas cylinder, the source gas should be connected to the **Aurora H2O** using the PURGE INLET on the analyzer. Ensure that the sample gas pressure is regulated to a just barely positive pressure and establish gas flow from the PURGE INLET to the **Aurora H2O** measurement cell.

7.7 Background Selection Lockout

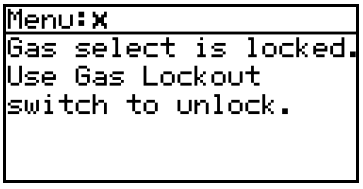
To prevent accidental selection or tampering, the **Background** menu option can be disabled using a mechanical switch located behind the **Aurora H2O** display. Access to the switch requires removal of the cover, and should be performed only in non-hazardous conditions.

Note: *Unless otherwise requested, the* **Aurora/H2O** *is shipped from the factory with the Background selection* ***unlocked****.*

The Lockout switch is positioned to the right of the Laser Indicator (see *Figure 89* below). When the switch is in the UP position, the Background Selection menu is **unlocked**. When the switch is in the DOWN position, the Background Selection menu is **locked**.

Figure 89: Background Selection Lockout Switch Location

Attempting to access the Background Gas Selection menu with the switch in the Locked Out (down) position will result in the following message being displayed:



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Appendix A. MODBUS RTU/RS485 Communications

A.1 Introduction

The **Aurora H2O** supports digital communications using the Modbus/RTU protocol, with 2-wire RS-485 or 3-wire RS-232C as the physical layer. Data rate can be specified ar rates from 1200 to 115200 bits per second (bps), with selectable parity.

Aurora H2O has two physically separate communications ports. Both ports can be selected for either RS-232 or RS-485 operation, and **Aurora H2O** can communicate with both ports simultaneously.

Note: **Aurora H2O** *supports the Modbus/RTU protocol as defined in:*

MODBUS Application Protocol Specification, V1.1b
&
MODBUS over Serial Line Specification and Implementation Guide V1.02.

Note: *The above referenced specifications are available from the* Modbus Organization *at* http://modbus-ida.org/

A.2 Modbus Functions and Data Types

The Modbus functions supported by **Aurora H2O** include:

- (0x03) Read Holding Registers
- (0x04) Read Input Registers
- (0x08) Diagnostics (Serial Line only) - only supports Echo subcommand
- (0x10) Write Multiple registers
- (0x11) Report Slave ID (Serial Line only)
- (0x2B/0x0E) Read Device Identification - only supports Basic Device Identification tags, which are:
  - VendorName
  - Product code
  - Revision number

Aurora H2O supports data types of Integer and Double/Float. Integer data types are always four (4) bytes long and should be read with a request for two registers (two bytes per each register, two registers total) at the address. Double/Float data types provide eight (8) byte double precision data or four (4) byte single precision data, depending on how many registers are requested. Four registers are used for double data types, and two registers are used for single precision data types.

A.3 Modbus Registers

All registers denoted with a bullet (•) in the Read-Only column are read-only registers and should be read with the function "Read Input Registers." All other registers can be read and written with "Read Holding Registers" or "Write Multiple Registers."

Note: *The* Modbus Register Address *map supported by* **Aurora H2O** *is shown in* Table 5 *below.*

Table 5: Modbus Register Map

Function	Parameter	Description	Range/State	Addr	Data Type	Read Only
System Status[1]	Status Register			0	Integer	•
	Status Register, Latched	Write 0 to clear		1000	Integer	
Analog Output	Output 1	Trim Sequence Start/Resume Live Output[2]		2100	Integer	
		Units	Reg. address of Meas.	2110	Integer	
		Type	0 = 4-20mA, 1 = 0-20mA	2120	Integer	
		Trim Reading Zero	3.0 ~ 5.2	2140	Double/Float	
		Trim Reading Span	10.0 ~ 22.2	2150	Double/Float	
		Upper of Value	–10000 ~ 10000	2160	Double/Float	
		Lower of Value	–10000 ~ 10000	2170	Double/Float	
		Test	% value of output, 0~100	2180	Double/Float	
	Output 2	Trim Sequence Start/Resume Live Output[2]		2200	Integer	
		Units	Reg. address of Meas.	2210	Integer	
		Type	0 = 4-20mA, 1 = 0-20mA	2220	Integer	
		Trim Reading Zero	3.0 ~ 5.2	2240	Double/Float	
		Trim Reading Span	10.0 ~ 22.2	2250	Double/Float	
		Upper of Value	–10000 ~ 10000	2260	Double/Float	
		Lower of Value	–10000 ~ 10000	2270	Double/Float	
		Test	% value of output, 0~100	2280	Double/Float	
	Output 3	Trim Sequence Start/Resume Live Output[2]		2300	Integer	
		Units	Reg. address of Meas.	2310	Integer	
		Type	0 = 4-20mA, 1 = 0-20mA	2320	Integer	
		Trim Reading Zero	3.0 ~ 5.2	2340	Double/Float	
		Trim Reading Span	10.0 ~ 22.2	2350	Double/Float	
		Upper of Value	–10000 ~ 10000	2360	Double/Float	
		Lower of Value	–10000 ~ 10000	2370	Double/Float	
		Test	% value of output, 0~100	2380	Double/Float	

Table 5: Modbus Register Map (cont.)

Function	Parameter	Description	Range/State	Addr	Data Type	Read Only
Alarm	All Alarm Status		0 ~ 7 (Bitfield)	3000	Integer	•
	Alarm 1	Status	0 = Not tripped, 1 = Tripped	3100	Integer	•
		Switch	0 = OFF, 1 = ON	3110	Integer	
		Units	Reg. address of Meas.	3120	Integer	
		Type	Set Point = 0, In Band = 1, Out Band = 2	3130	Integer	
		Upper	Depends on unit type	3140	Double/Float	
		Lower	Depends on unit type	3150	Double/Float	
	Alarm 2	Status	0 = Not tripped, 1 = Tripped	3200	Integer	•
		Switch	0 = OFF, 1 = ON	3210	Integer	
		Units	Reg. address of Meas.	3220	Integer	
		Type	Set Point = 0, In Band = 1, Out Band = 2	3230	Integer	
		Upper	Depends on unit type	3240	Double/Float	
		Lower	Depends on unit type	3250	Double/Float	
	Alarm 3	Status	0 = Not tripped, 1 = Tripped	3300	Integer	•
		Switch	0 = OFF, 1 = ON	3310	Integer	
		Units	Reg. address of Meas.	3320	Integer	
		Type	Set Point = 0, In Band = 1, Out Band = 2	3330	Integer	
		Upper	Depends on unit type	3340	Double/Float	
		Lower	Depends on unit type	3350	Double/Float	
Settings	Adjust	PPM Level offset adjust	–25.00 ~ +25.00	5210	Double/Float	
		Moisture reading average filter size	10 ~ 200 samples	5230	Integer	
	Clock	Hour	0~23	5410	Integer	
		Minutes	0~59	5420	Integer	
		Month	1~12	5430	Integer	
		Date	1~28/29/30/31	5440	Integer	
		Year	2000~2099	5450	Integer	
	External Pressure	Constant	0 ~ 3500.00 kPa	5510	Double/Float	
		Pressure Zero Calibration, mA	0~22 mA	5520	Double/Float	
		Pressure Span Calibration, mA	0~22 mA	5525	Double/Float	
		Pressure Zero Calibration, kPa	0~3500 kPa	5530	Double/Float	
		Pressure Span Calibration, kPa	0~3500 kPa	5535	Double/Float	
		Pressure Source	Constant Value = 0, Live Sensor = 1	5540	Integer	

Table 5: Modbus Register Map (cont.)

Function	Parameter	Description	Range/State	Addr	Data Type	Read Only
Device ID	Aurora H2O Serial Number	------	------	8100	8 Character Bytes	•
	Laser Serial Number	------	------	8200	8 Character Bytes	•
	Calibration Date	Month	1~12	8310	Integer	•
		Date	Depends on month	8320	Integer	•
		Year	2000~2100	8330	Integer	•
	System Up Time	MSDate	Uptime, in days	8400	Double/Float	•
Measure-ments	Dew Point	Dew Point °C	------	9110	Double/Float	•
		Dew Point °F	------	9120	Double/Float	•
		Equivalent Dew Point °C	------	9130	Double/Float	•
		Equivalent Dew Point °F	------	9140	Double/Float	•
	Temperature	Sample Temperature °C	------	9210	Double/Float	•
		Sample Temperature °F	------	9220	Double/Float	•
	External Pressure	kPa	------	9510	Double/Float	•
		MPa	------	9512	Double/Float	•
		PSIa	------	9520	Double/Float	•
		PSIg	------	9530	Double/Float	•
		kg/cm^2	------	9540	Double/Float	•
		Bars	------	9550	Double/Float	•
		mmHg	------	9560	Double/Float	•
	Internal Pressure	kPa	------	9610	Double/Float	•
		MPa	------	9612	Double/Float	•
		PSIa	------	9620	Double/Float	•
		PSIg	------	9630	Double/Float	•
		kg/cm^2	------	9640	Double/Float	•
		Bars	------	9650	Double/Float	•
		mmHg	------	9660	Double/Float	•
	H_2O Concentration	PPM	------	9710	Double/Float	•
		Lbs MMSCF	------	9720	Double/Float	•
		mg/sm^3	------	9730	Double/Float	•
	Vapor Pressure	kPa	------	9800	Double/Float	•

[1]Address 0 is the *System Status* register, and address 1000 is the latching version of the *System Status* register. That is, both registers will show the error bit if the error is currently present, but only the latching register will show it if the condition is no longer present. Writing 0 to the latching register will clear the error code it contains.

A.3 Modbus Registers (cont.)

[2]The *"Trim Sequence Start/Resume Live Output"* registers for the three outputs, (address 2100, 2200, 2300) accept certain values through the *Write Multiple Register* to trim the output current:

1. Write 0 to 2x00 to select the normal mA output (proportional to measurement).

2. Write 1 to 2x00 to reset the mA output trim to factory defaults.

3. Write 2 to 2x00 to output the "zero" current (~4.000 mA) and accept a calibration value written to 2x40.

4. Write 3 to 2x00 to output the "span" current (~20.000 mA) and accept a calibration value written to 2x50.

Note: *Attempting to write to Trim registers 2x40/2x50 without first writing to Trim State register 2x00 will fail with Modbus exception 4.*

At the end of calibration, write 0 to 2x00 to make **Aurora H2O** exit trim mode.

A.4 Modbus System Status Codes

Table 6 below lists the *System Status* codes and descriptions. It is possible for multiple status codes to be present; the hexadecimal values represent the bit set for a given condition.

Table 6: System Status Codes

Status	Description
0x00000000	**Aurora H2O** is operating normally, no faults or other indications.
0x00000008	**Aurora H2O** is reading moisture, but cannot detect the presence of methane.
0x00000010	The moisture level is below the system detection limits.
0x00000020	The temperature inside the electronics module exceeds 85°C. The laser is powered off until the temperature drops below 80°C.
0x00000040	The temperature transducer is operating out of limits, is disconnected, or has failed.
0x00000080	The internal (sample) pressure transducer is operating out of limits, is disconnected, or has failed.
0x00000100	The external (line) pressure transmitter is operating out of limits, is disconnected, or has failed. Occurs if source of the line pressure measurement is set to “Live”, and no pressure transmitter is attached.
0x00000200	Power supply under voltage
0x00000400	System ground fault
0x00000800	The temperature of the laser is not stable. This warning occurs briefly at power on, as the **Aurora H2O** sets the correct operating temperature. The laser is powered off until the temperature has stabilized.
0x00001000	**Aurora H2O** has reached the limit for adjusting the signal gain. Contact the factory for assistance.
0x00002000	**Aurora H2O** has reached the limit for adjusting the laser power. Contact the factory for assistance.
0x00004000	**Aurora H2O** could not detect any signal from the laser. Contact the factory for assistance.
0x00010000	**Aurora H2O** could not detect a signal returned from the sample cell, or the signal is below allowed limits. Check the mirror for contamination.
0x00020000	**Aurora H2O** has detected a failure in the laser temperature control. Contact the factory for assistance.
0x00040000	The pressure in the **Aurora H2O** sample cell is greater than 212 kPa (30.75 psia). Verify regulator and flow settings; check for blocked vent line or excessive back pressure.
0x00000000	The **Aurora H2O** temperature controller is was set beyond its operating limits. Contact the factory for assistance.
0x1yyyzzzz	Extended Error Code

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Warranty

Each instrument manufactured by GE Sensing is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of GE Sensing. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If GE Sensing determines that the equipment was defective, the warranty period is:

- one year from delivery for electronic or mechanical failures
- one year from delivery for sensor shelf life

If GE Sensing determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by GE Sensing, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a GE Sensing instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify GE Sensing, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, GE Sensing will issue a RETURN AUTHORIZATION NUMBER (RAN), and shipping instructions for the return of the instrument to a service center will be provided.
2. If GE Sensing instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, GE Sensing will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If GE Sensing determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

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GE
Sensing

DECLARATION OF CONFORMITY

DOC-0007, Rev. A

We,

GE Sensing
1100 Technology Park Drive
Billerica, MA 01821
USA

declare under our sole responsibility that the

Aurora H2O Moisture Analyzer

to which this declaration relates, is in conformity with the following standards:

- EN 60079-0: 2006
- EN 60079-1: 2007
- EN 60079-7: 2007
- EN 60529: 1991 +A1: 2000
- II 2 G Ex de IIB T6, T_a = -20°C to +65°C, IP66; FM09ATEX0065X (FM Global, UK)
- EN 61326-1: 2006, Class A, Table 2, Industrial Locations
- EN 61326-2-3: 2006
- EN 61010-1: 2001, Overvoltage Category II, Pollution Degree 2
- IEC 60825-1

following the provisions of the 2004/108/EC EMC, 2006/95/EC Low Voltage and 94/9/EC ATEX Directives.

The unit listed above and any ancillary equipment supplied with it do not bear CE marking for the Pressure Equipment Directive, as they are supplied in accordance with Article 3, Section 3 (sound engineering practices and codes of good workmanship) of the Pressure Equipment Directive 97/23/EC for DN<25.

Billerica - August 2010
Issued

Mr. Gary Kozinski
Certification & Standards, Lead Engineer

CE

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